Bulletin n° 127 Juillet-Août 1961

U. R. S. I.

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IN MEMORIAM

Dr K. S. Krishnan

Nous avons le grand regret d'annoncer le décès, le 14 juin 1961, du Dr K. S. Krishan, President du Comité National Indien et Directeur du Laboratoire National de Physique, qui a succombé à une crise cardiaque.

IN MEMORIAM

Dr K. S. Krishnan

We record our deep sorrow at the sudden demise of Dr. K. S. Krishnan, Chairman of the Radio Research Committee of India and Chairman of the National Physical Laboratory, who died of heart failure on 14th June 1961.

INFORMATION

Change of address

The address : Jodrell Bank Experimental Station, Lower Withington, Macclesfield, Cheshire, England, should now read as follows :

Nuffield Radio Astronomy Laboratories, Jodrell Bank, Macclesfield, Cheshire, England.

NATIONAL COMMITTEES

Czechoslovakia

BIBLIOGRAPHY

We inform our readers that the Institute of Radio Engineering and Electronics of the Czechoslovakian Academy of Sciences is issuing technical reports. The following are to be mentioned :

N° 12 (1961). — The depolarisation of electromagnetic waves scattered from rough surfaces, P. BECKMANN.

N° 13 (1961). — The scattering of waves by a periodic surface, P. BECKMANN.

N° 14 (1961). — A method of predicting the diurnal and annual variation in effective meteor trails for forward-scattered radio waves, P. BECKMANN.

N° 15 (1961). — Location of moving transmitters by the Doppler effect, J. POKORNY.

N° 16 (1961). — Ionisation durch Erdsatelliten, L. TRISKOVA.

N° 17 (1961). — The depolarisation of electromagnetic waves back-scattered from certain bodies, B. CHYTIL.

U. S. A.

1961 FALL U.R.S.I.-I.R.E. MEETING
23, 24, 25 October 1961 and
CONFERENCE ON TELLURIC AND GEOMAGNETIC FIELD VARIATIONS
Co-sponsored by U.R.S.I., the University of Texas and the Office of Naval Research

20, 21 October 1961

Both meetings are to be held at The University of Texas Student Union Building Austin, Texas.

Abstracts of papers submitted for the Geomagnetic Conference should be addressed to Chairman, Geomagnetic Conference, c/o A. W. Straiton, P.O. Box 8096, University Station, Austin 12, Texas.

Abstracts for papers submitted for the U.R.S.I.-I.R.E. Meeting should be addressed to Chairman Commission, U.R.S.I., c/o A. W. Straiton, P.O. Box 8026, University Station, Austin 12, Texas.

Geomagnetic Conference
Program Chairman — F. X. Bostick
The University of Texas, Austin, Texas

The Geomagnetic conference is primarily concerned with geomagnetic and telluric phenomena in the frequency range from 0.001 to 30 cycles per second.

The participating U.R.S.I. Commission are :

Commission 2 : Tropospheric Radio Propagation, *Chairman*, Prof. A. T. WATERMAN, Applied Electronics Laboratory Stanford University, Stanford, California.

Commission 3 : Ionospheric Radio Propagation, *Chairman*, Dr. C. G. LITTLE, National Bureau of Standars, Boulder, Colorado.

Commission 4 : Radio Waves and Circuits, *Chairman*, Prof. H. G. BOOKER, School of Engineering, Cornell University, Ithaca, New York.

Commission 6 : Radio Waves and Circuits, *Chairman*, Prof. L. Zadeh, Division of Electrical Engineering, University of California, Berkeley 4, California.

Commission 2. — Papers are encouraged in the following :

1. Refraction, scattering, absorption, emission, etc. in troposphere.
2. Surface and subsurface waves.
3. Terrain return from earth, lunar and planetary surfaces.
4. Non-ionized planetary atmospheres.

Commissions 3 and 4 have been redivided by the U. S. A. National Committee into Ionosphere and Magnetosphere defined as follows :

The ionosphere, in the main, controls propagation of terrestrial radio waves, reaches into the region of maximum electron density, and includes the regions below. It is the region where collisions are important and where local thermodynamic equilibrium may be said to exist.

The magnetosphere starts in the region of maximum electron density and is the geocentric region beyond. It is the region where charged particles travel in long trajectories controlled by magnetic fields.

COMMISSIONS ET COMITÉS

Commission III. — Radioélectricité Ionosphérique

DOCUMENTATION

Nous attirons l'attention de nos lecteurs sur les publications suivantes du Centre National d'Etudes des Telécommunications (C.N.E.T.) de France :

Rapport Technique n° 1229 (Groupe Ionosphère). — « Monographies sur les Observations ionosphériques au cours de l'A.G.I. 1957-1958 — Station de Casablanca-Rabat ».

Rapport Technique n° 1230 (Groupe Ionosphère). — « Monographies sur les Observations ionosphériques au cours de l'A.G.I. — Station de Dakar ».

DONNÉES IONOSPHÉRIQUES PENDANT L'A.G.I.

Voir p. 74.

Commission III on Ionospheric Radio

IONOSPHERIC DATA DURING I.G.Y.

See p. 76.

Comité de l'U.R.S.I. pour la Coopération Internationale en Géophysique (U.R.S.I.-C.I.G.)

DONNÉES IONOSPHÉRIQUES DE L'A.G.I.

Voir p. 74.

U.R.S.I. Committee for International Cooperation in Geophysics (U.R.S.I.-C.I.G.)

IONOSPHERIC DATA DURING I.G.Y.

See p. 76.

World Wide Soundings Commitee — W.W.S.C.

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A. P. Mitra,
Y. Nakata,
R. Rivault,
O. Sandoz,
J. O. Thomas,
J. W. Wright,
R. W. H. Wright.

SUB-COMMITTEE ON IONOSONDE CHARACTERISTICS

BIBLIOGRAPHY

We inform our readers that the following paper has been published in the *Archiv der Elektrischen Uebertragung* (Vol. 14, n° 10, 1960).

Active High Frequency Spectrometer for Ionospheric Echo Sounding III. Determination of the real from the virtual reflection height, by Adolf K. PAUL.

An English working translation of this paper is available from the WWSC.

ATTRIBUTIONS DE FREQUENCES

Comité Inter-Unions
Comité de l'U.R.S.I.

DOCUMENTATION

Nous attirons l'attention des membres de ces Comités sur un article publié dans la *Revue de l'Union Européenne de Radiodiffusion*, (nº 67-A, juin 1961, p. 10) et intitulé : « Comité International d'Enregistrement des Fréquences (I.F.R.B.) — Mise en vigueur du nouveau Règlement des Radiocommunications de Genève (1959) ».

FREQUENCY ALLOCATIONS

Inter-Union Committee
U.R.S.I. Committee

BIBLIOGRAPHY

Attention of the members of both Committees should be called to a paper published in the *European Broadcasting Union Review* (nº 67-A, June 1961, p. 110) under the title « International Frequency Registration Board (I.F.R.B.) — Entry into force of the new Radio Regulations (Geneva, 1959) ».

Inter-Union Committee on Frequency Allocations for Radio Astronomy and Space Science

THE TOLERABLE LEVEL OF INTERFERENCE IN THE RADIO ASTRONOMY FREQUENCY BANDS [1]

I.U.C.A.F. (Doc. 11)

1. — Introduction

In making request for the reservation of « quiet » frequency bands radio astronomers have often referred to the need for complete protection from interference, but have not usually expressed their requirements quantitatively. The purpose of this paper is to state the degree of protection required and to provide a basis for assessing the harm that might be done to radio astronomy by the sharing of frequencies with other services. A definition of « harmful interference » in terms of the field strength at the site of the radio telescope is proposed.

2. — Radio Astronomy Observatories in the United Kingdom

The sensitivity of radio star observations is now such that a radio signal can be detected from a distant extraterrestrial transmitter even when the power intercepted by the whole surface of the earth is only one microwatt. It has been estimated that if the whole of the energy collected by radio astronomers since 1945 were added up it would amount to about 1 erg work-about the work done in lifting 1 milligram through 1 cm.

These sensitivities are achieved by various different procedures of integration. The radio signals are broad band noise signals, the finest frequency structure being found in the Hydrogen line at 1420 Mc/s, where a receiver bandwidth of only 5 kc/s is used for some observations of Galactic structure. Most observations

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[1] This paper was prepared after discussion between the major radio astronomy observatories in the United Kingdom, arranged by the Radio Research Station of the D.S.I.R. A paper on similar lines, prepared by Dr. J. W. Findlay of the National Radio Astronomy Observatory of U. S. A. formed the basis of this discussion, and has greatly helped in the preparation of this paper (see *Inf. Bull.*, nº 124, p. 51).

are made of a continuous frequency spectrum, and the bandwidth used is only limited by the available band of clear frequencies. Integration is a process of measuring an average of the signal received in this band over a period of time. This period may be very long indeed, as for example when the aperture synthesis radio telescopes at Cambridge combine data collected over a period of several weeks, or again if the steerable radio telescope at Jodrell Bank follows a single source for several hours, but for practical purposes it is fair to say that integration to obtain any single piece of information does not usually extend beyond 100 seconds of time. The calculations of sensitivity in this paper are based solely on this integration time, and on the maximum bandwidths available as specified in the I.T.U. Radio Regulations. Very little further reference need be made to the different characteristics of the different radio telescopes. The frequencies in use are at the present a compromise between the desirable series often quoted in resolutions of U.R.S.I., I.A.U. and C.C.I.R., and the dictates of previous frequency plans, but in fact the series of frequencies already in use from 38 Mc/s up to 3000 Mc/s shows that all of the proposed frequency bands are important, and each will be included in calculations. However, there is very little experience of frequencies in the region of 10.000 Mc/s and above, and conclusions cannot here be so definite at present.

3. — Definitions of Sensitivity

(1) *Noise power and Temperature.*

Since the signals to be detected by the receiver are in the form of random noise we may measure then by comparison with the power received from a resistance heated to a temperature T°K. The noise power in a bandwidth B will then be kTB, where k is Boltzman's constant (1.4×10^{-23} watts $(c/s)^{-1}$ $^{o}K^{-1}$).

(2) *Receiver Input noise.*

The unwanted noise signal in the input of a receiver connected to a radio telescope consists partly of noise generated in the receiver itself and partly of noise from the aerial. This in turn is partly of extraterrestrial origin and partly due to thermal emission from the ground and atmosphere. The total of all these may

be expressed as a temperature T*eff*, which is the effective receiver input noise level. Parametric amplifiers and masers now provide very low noise levels, but at the lower frequencies the noise contributions from the aerial are predominant. Values of T*eff* used in this paper represent the sum of typical values of aerial temperature and the best available values of receiver noise.

(3) *Power Flux.*

A radio telescope collects radio waves over an area A, so that the signal fed to the receiver is the product FA where F is the power flux of the signal (having due regard to polarisation). Since a broadband signal is being received, F is specified in power per unit area per unit bandwidth. Radio stars with a power flux of 10^{-26} watts m^{-2} $(c/s)^{-1}$ are observed with the Cambridge radio telescope, and the output fluctuation level is an order of magnitude less than this.

The actual power fed to the receiver depends on bandwidth as well as area ; in comparing a noise power with the power from an interfering CW signal the radio star power flux must therefore be increased by the bandwidth, which is commonly of order of 4×10^6 c/s.

(4) *Field Strength.*

The field strength E of an interfering signal is related to the total power flux P by the relation $E = \sqrt{377P}$ where P is in the units watts m^{-2} and E in the units volts m^{-1}.

4. — Discrimination against Direction

Most of the probable sources of interference will not lie in the direction of the main aerial beam, and those that cross it may do so in such a short time that the interfering signal is integrated for only a few seconds. The sidelobe patterns of radio telescopes are very varied, but it is fairly certain that sidelobes of any high gain aerial will give over an appreciable fraction of the sky the sensitivity of a single dipole aerial. Without attempting a detailed comparison of radio telescopes, we will adopt this sensitivity for all directions except the main beam and near-in sidelobes. We are now in a position to estimate the harmful effects of transmitters

on the ground, which will always be likely to appear in sidelobes ; separate consideration must be given to transmission or reflection from aeroplanes and satellites which may appear in or near the main beam.

5. — Interference Level

First we summarize the assumptions made above :

(1) The interfering signal is integrated for 100 seconds, so that it is treated as indistinguishable from the wanted signal. This is often the case, since the interfering signal will usually vary with time at a rate comparable with the scanning action of the radio telescope. Such variations are either inherent in the signal, or are generated in varying propagation conditions, or may again arise from the motion of the sidelobe pattern during a scan.

(2) The interfering signal is picked up in the side lobe pattern, usually where it intersects the horizon. The following table shows the power flux, and field strength, of the interfering signals which, in these circumstances, will give an increase of 10 % in the effective receiver noise level in frequency bands of great interest to radio astronomers.

Table

Frequency f(Mc/s)	Bandwith B(Mc/s)	Effective receiver noise temperature Tef(°K)	Flux of interfering signal P(10^{-18}W.m.$^{-2}$)	Field strength E(10^{-8}V.m.$^{-1}$)
2695 (and above)	10	50	2	2.5
1413	25	80	2	2.5
408	4	80	0.5	1
178	4	600	0.3	1
80	2	1200	0.3	1
38	1	5000	0.1	0.5

6. — Examples of Harmful CW Interference Levels

The very low field strengths of the Table correspond to very small powers for transmitters within visual range. An isotropic

transmitter with power P_t gives at a distance of D kilometres a field strength E given by

$$E \sim \frac{P^{1/2}}{200D}$$

For example, at a distance D = 10 km the maximum power that can safely be radiated, taking $E = 10^{-8}\ Vm^{-1}$, is only 10^{-10} watt. It may be argued that larger powers may safely be radiated under various circumstances, such as in a directed beam, or with specially arranged modulation characteristics, but the safe power level is so low that no useful purpose would be served by making such transmissions.

Beyond the visual horizon ground propagation becomes increasingly attenuated, and at distances of say 100 km the expected field strength from low-power transmitters may not exceed the allowable level. However, at this distance aircraft reflection must be taken into account.

It is now clear that within visual range there can be no deliberate transmission allowed within the frequency bands. Accidental transmission, for example of harmonics of lower frequency transmitters, must be accounted the most important hazard in this region, since experience has shown that ignition noise and man-made static are only serious at distances of a few miles from the observatory.

7. — Aircraft Reflection

The field strength of a signal reflected from a distant transmitter by an aircraft in visual range of both transmitter and radio telescope is given by

$$E \sim 1.5\ \frac{\sqrt{PA}}{r_1\ r_2} \times 10^{-6} \text{ volts per metre}$$

where P is the power transmitted towards the aircraft in watts, A is reflecting area aircraft in square metres, and r_1, r_2 are the ranges in kilometres of the aircraft from the transmitter and radio telescope respectively.

Continuing on the basis of the previous sections, where a tolerable value of E for sidelobe reception was used, we calculate allowable transmitter powers for (i) a single aircraft with A = 10 *sq*

metres with both transmitter and radio telescope near the horizon, (ii) the same aircraft overhead at either the transmitter or radio telescope.

(i) With $r_1 = r_2 = 400$ km, A = 10 m², a field of 10^{-8} volts m^{-1} is obtained from P = 100 kilowatts. Hence any transmitter at a distance of less than 800 km must have a power less than 100 kW radiated near horizontal, for each visible reflecting aircraft. There will probably be at any time about 20 such aircraft, giving a save limit of 5 kW.

(ii) With $r_1 = 10$ km, $r_2 = 400$ km, A = 10 m², a field of 10^{-8} volts m^{-1} is obtained from P = 60 watts. Again a reduction must be made for the number of transmitters and reflectors involved at any time.

On occasions an aircraft will fly through the main beam of the radio telescope and much higher signal levels will be received. Although this is an unlikely occurrence with large instruments, it is quite probable that an aircraft will cross near in sidelobes which may have effective sensitivity about 20 *d*B greater than the isotropic level.

These considerations show that high power transmissions anywhere within 1000 km, would cause intolerable interference. At the extremes of this range a limit of about 1 kW must be imposed, decreasing to about 10 watts at 500 km, and decreasing more rapidly at shorter ranges where anomalous propagation and ground scattering may become more important.

Beyond 1000 km, reflections from satellites must also be considered. A satellite at a height of 300 km extends the range under consideration to 4000 km, but at this range a troublesome reflection from a satellite would need a transmitter power of the order of 1 megawatt, even if observed in the stronger near-in sidelobes. The limitations imposed by satellite reflections are seen to be less serious than for aircraft, but they must be taken into account if any deliberate attempt is made to establish communication via passive reflecting satellites, since high powers and large reflecting areas will then be used.

8. — Sharing Frequency Bands with other Services

The I.T.U. regulations allow for the sharing of all radio astronomy frequency bands except 1400-1427 Mc/s with other services,

usually « Fixed and Mobile except aeronautical mobile ». It is clear from the foregoing remarks that allocations to such services are almost impossible without harmful effects to radio astronomy (Existing arrangements for sharing are believed to be on the limits of sensitivity of present instruments, but it is difficult to make positive identifications of the sources of low-level interference so as to make any precise tests). The possibility arises, however, that the allocations can be made on a time-sharing basis.

Most radio-astronomical observations are made continuously, but it is often possible to arrange observing schedules so that, for example, only half of the sky is observed in any series. However, such schedules must be made to depend on sidereal time, not solar time, and it is difficult to imagine any other user content with a division of time that occurred at a different time each solar day. The only practical form of time sharing would be with another service that was required to operate for infrequent periods which always left many days clear between whiles. As an example, an experimental service operating on one day each month would mean only that this proportion of observing time was lost. But the days of operation must be infrequent, and known well in advance so that observing schedules can be arranged accordingly.

REPORT TO THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS ON THE WORK

(25 June 1961)

I.U.C.A.F. (Doc. 12)

1. The above Inter-Union Committee was established at the meeting of the Executive Committee of I.C.S.U. held in Lisbon in october 1960. The principal objects of the Committee are to co-ordinate the radio frequency requirements for present and future research in radio astronomy and space science, and to make formal representations to the appropriate international telecommunications organizations to secure the allocation of frequency channels to meet these requirements.

2. The Constitution and Terms of Reference of the Committee are given in Doc. I.U.C.A.F./1 (*U.R.S.I.*, *Inf. Bull.*, 123).

3. A summary of the relevant sections of the Radio Regulations drawn up by the International Telecommunication Union at

Geneva in 1959 has been studied by the Committee with a view to making more specific recommendations on the protection of radio frequencies for the use of radio astronomy and space science.

4. While some twenty frequencies for radio astronomy and thirteen for space research are mentioned in the Geneva (1959) allocation lists, only a few of these are primary allocations, that is to a service having a prior choice to the frequency indicated. While the users of allocations on a secondary service basis can claim protection from harmful interference from other secondary services, they cannot claim corresponding protection from stations of a primary service to which frequencies are already assigned or may be assigned at a later date.

5. — A review of the present position of the « Allocation of Radio Frequencies for Scientific Research » has been prepared for publication in the *I.C.S.U. Review* for April 1961, Vol. 3, nº 2, pp 61-66.

6. During 27-28 March 1961, a meeting of the working party of the Inter-Union Committee was held in Brussels, under its Chairman, Dr. J. F. Denisse and attended By Prof. J. H. Oort, President I.A.U., Prof. H. C. van de Hulst, President C.O.S.P.A.R., Col. E. Herbays, Secretary-General U.R.S.I., and Dr R. L. Smith-Rose, Secretary-General I.U.C.A.F.

At this meeting, Budgetary Estimates for the calendar years 1961-62-63 were drawn up, based on the work and expenditure which would be involved in preparation for the Extraordinary Administrative Conference of the International Telecommunication Union (I.T.U.) in 1963, at which the future allocations of radio frequencies for all purposes will be reviewed.

The Budgetary Estimate for 1961 is given in Appendix I of Doc. I.U.C.A.F./8 and it is considered that at least the same income will be required for the years 1962 and 1963, to deal with important international radio conferences being held in those years.

7. At the Brussels meeting also, it was agreed that the Secretary General should draw up a list of persons who are concerned with the allocation of frequencies in various countries, and who might usefully assist as liaison between the Committee and national administrations.

In accordance with paragraph 1 of Doc. I.U.C.A.F./1, the Committee has co-opted Dr. J. D. H. van der Toorn as a consultant, and has already benefitted by his attendance and expert advice at the Stockholm meeting of the European Broadcasting Conference (see para. 9).

8. The Chairman and Secretary General of the Committee have had discussions in London and Paris with the N.A.T.O. authorities who are operating some services in the frequency band covered by the Deuterium line (322-329 Mc/s). A working party of N.A.T.O. and I.U.C.A.F. is being set up to explore the possibilities of a mutually acceptable arrangement for sharing this frequency band, so as to facilitate its use by radio astronomers not only for measurements on the Deuterium line, but also as a significant part of the whole spectrum.

9. At the meeting of the European Broadcasting Conference which was held in Stockholm from 25 May to 22 June 1961, the Inter-Union Committee was formally established as a participating international organization : and it was represented by Dr. H. Sterky, Dr. J. D. H. van der Toorn, Prof. B. Linblad (in place of Prof. J. H. Oort) and Dr. R. L. Smith-Rose (Secretary-General).

10. The Stockholm Conference mentioned in 9 was attended by delegates of some 41 national administrations ; and was concerned with the allocation of frequencies to several thousand radio and television stations which are being planned to operate in the very high frequency (V.H.F.) and ultra high frequency (U.H.F.) broadcasting band in the future.

At this Conference the I.U.C.A.F. made two specific recommendations.

11. First, it put forward a formal recommendation that in the planning of European Television Stations in Broadcasting Band V (582-960 Mc/s) the use of the frequency channel n° 38 (606-614 Mc/s) should be avoided so as not to interfere with the present development and use of radio astronomy in this band. This recommendation, which was given in Appendix II of Doc. I.U.C.A.F./8, was very opportune ; and it was noted during the Conference that delegates concerned with the planning of the European network of television stations were doing their best to give effect to this Recommendation.

12. Secondly, it was pointed out to the Conference that the third harmonic of stations working in channel 21 (frequencies 470-478 Mc/s), and the second harmonic of stations in channels 50 (702-710 Mc/s) and 51 (710-718 Mc/s) fall within the hydrogen line band (1400-1427 Mc/s), which has been allocated exclusively on an international basis for radio astronomy. A request was therefore made that all users of television transmitting stations in these channels (*i.e.* 21, 50 and 51) should take the greatest possible precautions to ensure that harmonics from these stations do not cause interference with radio astronomy.

13. It connection with the allocation of frequencies for space research, in has been agreed to press strongly for an exclusive allocation of the band 136-137 Mc/s, which is now in use at a large number of earth satellite tracking stations throughout the world.

14. In addition to its participation in the European Broadcasting Conference, mentioned in paragraphs 9-12, the Inter Union Committee has now been accepted as a recognized participating international body in the work of the International Radio Consultative Committee (C.C.I.R.), which is the technical adviser on all radio matters to the International Telecommunication Union (I.T.U.). In this way, the I.U.C.A.F. has now attained a recognized status on a world-wide basis as representing the scientific requirements of its member bodies (U.R.S.I., I.A.U. and C.O.S.P.A.R.) to the organization (I.T.U.) responsible for the international regulation of radio for all purposes, and the allocation of frequencies for all national andnternational services. This association is likely to be of a permanent nature and will undoubtedly prove of great benefit to all aspects of scientific research involving radio waves.

R. L. Smith-Rose,
Secretary General

DOCUMENTS DISTRIBUTED

The following documents have been distributed to the members of the I.U.C.A.F. :

Doc. I.U.C.A.F./13. — A report received from the U. S. National Academy of Sciences entitled : « Frequency Allocations for the Radio Astronomy Service — A statement for Position ».

Doc. I.U.C.A.F./14. — A reprint of four papers on : « Project West Ford » published in the *Astronomical Journal*, April 1961.

RECHERCHE RADIOÉLECTRIQUE DANS L'ESPACE

Colloque sur les Recherches en Communications Spatiales

(England text : p. 30)

Le Colloque sur les Recherches en Communications Spatiales, organisé par le Comité de l'U.R.S.I. pour les Recherches Radioélectriques dans l'Espace, avec la collaboration du Comité National Français, se tiendra du lundi 18 septembre au vendredi 22 septembre à Paris, Ministère des Postes et Télécommunications, 20, avenue de Ségur, 7e arrondissement.

Séance d'ouverture. — La séance d'ouverture sera présidée par M. Michel Maurice Bokanowski, Ministre des Postes et Télécommunications, qui prononcera l'allocution d'ouverture. Prendront ensuite la parole M. le Docteur J. R. Pierce, Président du Comité d'Organisation du Colloque, M. le Docteur R. L. Smith-Rose, Président de l'Union Radio Scientifique Internationale, M. l'Ingénieur Général A. Angot, Président du Comité National Français de Radioélectricité Scientifique, M. le Docteur L. Jaffe, représentant de l'Administration Américaine pour l'Aéronautique et l'Espace (N.A.S.A.).

Secrétariat du Colloque. — Le Secrétariat du Colloque est assuré par M. F. du Castel, C. N. E. T., Issy-les-Moulineaux, Seine, tél. LEC 40-00.

Programme Technique des séances

Lundi 18 septembre, 9 h. 30 : *Séance d'ouverture.*

Présidence : Dr J. R. Pierce, Président du Comité d'Organisation.

Présentation générale : :

— H. Stanesby and F. J. Taylor, G. P. O., U. K : « Problèmes scientifiques et de recherches des systèmes de communications par satellites ».

Lundi 18 septembre, 14 h. 30 : *Problèmes de lancement, de stabilisation et de poursuite.*

Présidence : Pr. V. SIFOROV, Académie des Sciences, Moscou.

Présentations :

— Dr M. ROSEN, N.A.S.A., U. S. A. : « Lancement des satellites ».

— Dr R. ROBERSON, U. S. A. : « Commande d'attitude et maintien en position ».

Communications :

— Dr J. C. SIMON, C. S. F., France :« Rayonnement d'un satellite non stabilisé ».

— E. G. C. BURT, R. A. E., U. K. : « Influence des torsions cycliques sur la commande d'attitude d'un satellite pointé vers la terre ».

F. GÉRARDIN, C. F. T. H., France : « Problèmes de poursuite des satellites ».

Mardi 19 septembre, 9 h. 30 : *Problèmes de fréquences et de propagation.*

Présidence : Dr R. L. SMITH-ROSE, Président de l'U.R.S.I.

Présentations :

— Dr R. L. SMITH-ROSE, U.R.S.I., U. K. : « Les attributions de fréquences pour les expériences de communications spatiales ».

— Dr K. RAWER, F. T. Z., F. D. R. : « Influences de propagation en communications spatiales ».

Communications :

— Dr W. R. VINCENT, S.R.I., U. S. A. : « Interférence dans les systèmes de communications par satellites ».

— Dr T. F. ROGERS, M.I.T., U. S. A. : « Effets de propagation importants dans les communications par satellites ».

Mardi 19 septembre, 14 h. 30 : *Systèmes de modulation en communications par satellites.*

Présidence : Dr L. JAFFE, représentant de la N.A.S.A., U. S. A.

Présentation :

— G. BATTAIL, C.N.E.T., France : « Etude générale comparée des systèmes de modulation ».

Communications :

— W. L. Wright, M.W.T., U. K. : « Le choix de la méthode de modulation optimale dans les systèmes de communications par satellites

— C. Cardot, C. G. E., France. : « La compression de fréquence et son utilisation pour les télécommunications par satellites ».

— Dr S. C. Ghose, E. M. I., U K. : « Méthodes digitales en communications spatiales ».

— Dr J. R. Pierce, B.T.L., U. S. A. : « Remarques sur les méthodes de modulation pour les communications par satellites.

Mercredi 20 septembre, 9. h 30 : *Equipements terriens.*

Présidence : Pr. I. Ranzi, Président de la Commission d'Etudes nº IV du C.C.I.R.

Présentation :

— W. K. Victor, J.P.L., U. S. A. : « Equipements au sol pour les communications par satellites.

Communications :

— A. Robieux, C.G.E., France : « Etude théorique des propriétés des antennes à faible bruit ».

— R. Liger, S.A.T., France : « Utilisation des systèmes directionnels pour la réduction du facteur de bruit ».

— G. Broussaud, C.S.F., France : « Maser à large bande et grande stabilité ».

— Dr S. C. Ghose, E.M.I., U. K. : « Le tube cathodique EMI pour le décodage des systèmes de communication digitaux ».

Mercredi 20 septembre, 14 h. 30 : *Equipements des satellites.*

Présidence : Prof. P. Aigrain, Faculté des Sciences, Paris.

Présentation : Dr I. M. Ross, B.T.L., U. S. A. : « Eléments utilisés pour les satellites ».

Communications :

— J. Picquendar, C.F.T.H., France : « Différents systèmes de production d'énergie à bord des satellites ».

— D. G. Mazur, N.A.S.A., U. S. A. : « Problèmes des éléments constitutifs d'un satellite ».

— F. Desvignes, L.E.P., France : « Cellules solaires photovoltaïques ».

Jeudi 21 septembre, 9 h. 30 : *Systèmes de communications par satellites.*

Présidence : Ing. Général R. SUEUR, Directeur adjoint du C.N.E.T., France.

Communications :

— Dr S. P. BROWN, Avent, U. S. A. : « Le programme Avent ».
— R. P. HAVILLAND, G.E. Co., U. S. A. : « Satellite stabilisé à altitude moyenne ».
— Dr J. L. GLASER, B.T.L., U. S. A. : « Satellites en orbites aléatoires à basse altitude ».

Vendredi 22 septembre, 9 h. 30 : *Système de communications par satellites* (suite).

Présidence : Cap. C. F. BOOTH, General Post Office, U. K.

Communications :

— Dr L. JAFFE, N.A.S.A., U. S. A. : « Le programme de satellites passifs de la N.A.S.A. ».
— Dr W. E. MORROW, M.I.T., U.S . A. : « Communications par dipoles orbitaux ».
— Dr C. M. CRAIN, Rand Co, U. S. A. : « Radiodiffusion par satellites ».

Vendredi 22 septembre, 14 h. 30 : *Autres problèmes de communications spatiales.*

Président : Ingénieur Général A. ANGOT, Président du C.N.F.R.S.

Communications :

— Cap. C. F. BOOTH, G.P.O., U. K. : « Les projets internationaux de systèmes de communications par satellites ».
— Dr S. H. REIGER, Rand Co., U. S. A. : « Problèmes économiques des systèmes de communications par satellites »
— J. R. BRINKLEY, Pye, U. K. : « Aspect économiques des communications spatiales ».
— K. W. PEARSON, S. T. L., U. K. : « Problèmes de transmission des communications par satellites et en particulier du temps de propagation ».

LISTE PROVISOIRE DES INVITÉS AU COLLOQUE (juillet 1961)

Allemagne — Germany :

— Dr BRUHL, Telefunken GmbH, Söflinger Str. 100, Ulm.

— Dr CARL, Standard Elektrik Lorenz A.G., Stuttgart-Zuffenhausen.

— Prof. DIEMINGER, Max-Planck-Institut, Lindau üb. Norheim/Han.

— Dr HOLZWARTH, Siemens & Halske A.G., Hofmannstr. 51, München.

— PROF. KNAUSENBERGER, Deutsche Bersuchsanstalt für Luftfahrt, Oberpfaffenhofen/Obb.

— Prof. LUTZ, Deutsche Forschungsanstalt für Luftfahrt, Braunschweig, Flughafen.

— Prof. NESTEL, Telefunken GmbH, Söflinger Str., 100, Ulm.

— Mr PILZ, Forschungsinstitut für Physik der Strahlantriebe, Stuttgart-Flughafen.

— Mr QUIRING, Deutscher Wetterdienst, Frankfurter Str. 135, Offenbach/Main.

— Prof. RAWER, Ionosphäreninstitut, Breisach/Rhein.

— Dr SCHULZE, Bundesverteidigungsministerium T II 3, Emerkeilstr. 27, Bonn.

— Dr ULBRICHT, Deutsche Versuchsanstaltfür Luftahrt, Oberpfaffenhofen/Obb.

Canada :

— M. J. C. W. SCOTT, Defence Research Member, Canadian Joint Staff, London 66 Ennismore Gardens, London S. W. 7, Angleterre.

Etats-Unis — United States :

— Dr Samuel P. BROWN, Advent Management Atgency (U.S.A.A. M.A.) Fort Monmouth, New Jersey.

— Dr H. BUSIGNIES (ou M. ARMIG G. KANDOIAN) International Telephone and Telegraph Corporation 67 Broad Street, New-York.

— Dr CULLEN M. CRAIN, The Rand Corporation 1700 Main Street Santa Monica, California.

— M. Victor EVANS, Office of the Director of Defense Research and Engineering, Washington 25, D. C.

— Dr J. L. GLASER, Bell Telephone Laboratories, Murray Hill, New Jersey.

— M. Robert P. HAVILAND, General Electric Company, Girard Building, 21 So. 12th Street, Philadelphia, Pa.

— Dr J. W. HERBSTREIT, Central Radio Propagation Laboratory National Bureau of Standards, Boulder, Colorado.

— M. Leonard JAFFE, National Aeronautics and Space Administration, 801, 19th Street, N. W., Washington 25, D. C.

— M. Daniel G. MAZUR, Goddard Space Flight Center, National Aeronautics and Space Administration, 4555 Overlook Avenue, S. W. Washington, D. C.

— M. Sidney METZGER, Astro-Electronic Products Division Radio Corporation of America, Princeton, New Jersey.

— Dr Walter E. MORROW, Jr., Massachusetts Institute of Technology Lincoln Laboratory, Lexington 73, Massachussetts.

— General James D. O'CONNELL, General Telephone and Electronics Laboratories, 1177 University Drive, Menlo Park, California.

— Dr A. C. PETERSON, Stanford Research Institute, Menlo Park, California.

— Dr J. R. PIERCE, Bell Telephone Laboratories, Murray Hill, New Jersey.

— Dr S. H. REIGER, The Rand Corporation, 1700 Main Street, Santa Monica, California.

— Dr R. E. ROBERSON, 1100 North Cerritos Drive, Fullerton, California.

— Dr T. F. ROGERS, Massachusetts Institute of Technology Lincoln Laboratory, Bldg. C-229, Lexington 73, Massachusetts.

— Dr H. A. ROSEN, Radar Division, Hughes Aircraft Company, Culver City, California.

— M. Milton ROSEN, National Aeronautics and Space Administration, 1512 H Street, N. W., Washington 25, D. C.

— Dr Ian M. Ross, Bell Telephone Laboratories, Murray Hill, New Jersey.

— Mr R. B. Rypinski, c/o Dr G. E. Mueller, Space Technology Laboratories, 5730 Arbor Vitae, Los Angeles 45, California.

— Professor S. Silver, Space Sciences Laboratory, 3 Leuschner Observatory, University of California, Berkeley 4, California.

— Dr Ronald Smelt, Lodheed Missile and Space Division, P. O. 504, Sunnyvale, California.

— Brig. General W. M. Thames, U. S. Advent Management Agency Fort Monmouth, New Jersey.

— M. Walter K. Victor, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena 3, California.

— Dr Wilbur R. Vincent, Stanford Research Institute, Menlo Park, California.

France :

— J. Voge, C.N.E.T., avenue de la République, Issy-les-Moulineaux, Seine.

— M. Thue, C.N.E.T., avenue de la République, Issy-les-Moulineaux, Seine.

— F. du Castel, C.N.E.T., avenue de la République, Issy-les-Moulineaux, Seine.

— G. Battail, C.N.E.T., avenue de la République, Issy-les-Moulineaux, Seine.

— J. C. Simon, C.S.F., D.P.A., Corbeville, Orsay, S.-et-O.

— G. Broussaud, C.S.F., D.P.A., Corbeville, Orsay, S.-et-O.

— G. Mandel, C.G.E., 33, rue Emeriau, Paris 15e.

— C. Cardot. C.G.E., 33, rue Emeriau, Paris 15e.

— J. Robieux, C.G.E., 33, rue Emeriau, Paris 15e.

— P. Chavance, C.F.T.H., rue des Fossés Blancs, Gennevilliers, Seine.

— J. Picquendar, C.F.T.H., 1, rue des Mathurins, Bagneux, Seine.

— Gerardin, C.F.T.H., 1, rue des Mathurins, Bagneux, Seine.

— J. Baudin, L.M.T., 46, quai de Boulogne, Boulogne, Seine.

— J. Dockes, S.A.T., 41, rue Cantagrel, Paris 13e.

— Liger, S.A.T., 41, rue Cantagrel, Paris 13e.

— C. Ducot, L.E.P., 23, rue du Retrait, Paris 20e.
— Desvigne, L.E.P., 23, rue du Retrait, Paris 20e.
— A. Laurens, T.R.T., 26, rue Boyer, Paris 20e.
— Anguera, R.T.F., 107, rue de Grenelle, Paris 7e.
— P. Deman, D.S.R., 5, rue Froidevaux, Paris 14e.
— P. Blatrix, Ministère des P. et T., 20, avenue de Ségur, Paris 7e.
— Dorliac, S.E.R.E.B., 55, rue Victor Hugo, Courbevoie, Seine.
— J. P. Magnen, D.R.M.E., 10, rue St-Dominique, Paris 7e.
— J. P. Blassel, C.O.P.E.R.S., 36, rue La Pérouse, Paris 16e.

Hollande — Netherlands.

— M. l'Ingénieur G. de Vries, Laboratoire de Recherches Philips, Eindhoven.
— M. l'Ingénieur J. J. Vormer, Direction Générale des P.T.T. 12 Kortenaerkade, La Haye.
— M. l'Ingénieur L. R. M. Vos de Wael, Laboratoire Dr Neher, Leidschendam.

Italie — Italy.

— Prof. I. Ranzi (Chairman, Study Group 4, C.C.I.R.), c/o I.S.P.T. Viale Trastevere 189, Rome.

Japon — Japan.

— Dr Shogo Namba, Tokyo.

Nouvelle-Zelande — New Zealande.

— M. A. H. Allan, Department of Scientific and Industrial Research Dominion Physical Laboratory Private Bag, Lower Hutt.

Royaume-Uni — United Kingdom.

— R. L. Smith-Rose (U.R.S.I.).
— J. H. Thomson (Jodrell Bank).
— R. Dalziel (R.R.S. Slough).
— F. J. D. Taylor, G.P.O.
— J. R. Brinkley, Pye.

— PHILIPS, B.B.C.
— S. C. GHOSE, E.M.I.
— W. L. WRIGHT, Marconi.
— C. R. TURNER, Hawker Siddeley.
— K. W. PEARSON, Standard Telecomm. Lab.
— G. F. BROWN, Aberystwyth.

U. R. S. S. — U. S. S. R.

— Prov. V. SIFOROV, Academy of Sciences, Moscow.

C. C. I. R.

— Dr E. METZLER, Director, C.C.I.R., Palais Wilson, Genève, Suisse.

SPACE RADIO RESEARCH

Symposium on Space Communication Research

The Symposium on Space Communication Research, organized by the U.R.S.I. Committee on Space Radio Research with the collaboration of the French National Committee, will be held from September 18th to 22nd in Paris, at the Ministère des Postes et Télécommunications, 20, avenue de Ségur, 7e arrondissement.

Opening session. — The chairman of the opening session will be Mr. Michel Maurice Bokanowski, Minister of Posts and Telecommunications, who will deliver the inaugural speech. The chair will then be taken by Dr J. R. Pierce, Chairman of the Organizing Committee of the Symposium, Dr. R. L. Smith-Rose, President of the International Scientific Radio Union, Ing. Gen. A. Angot, President of the French National Committee for Scientific Radio, Dr L. JAFFE, representative of the National Aeronautics and Space Administration (N.A.S.A.) of the U. S. A.

Secretariat of the Symposium. — The secretariat will be assumed by Mr. F. du Castel, C.N.E.T., Issy-les-Moulineaux, Seine, tel. LEC 40-00.

TECHNICAL PROGRAMME

Monday, September 18, 09.30 a. m. : *Opening session.*

Chairman : Dr J. R. PIERCE, chairman of the Organising Committee.

General presentation :

— H. STANESBY and F. J. TAYLOR, G.P.O., U. K. : « The scientific research problems of satellite communications systems ».

Monday, September 18, 02.30 p. m. : *Launching, attitude control and tracking problems.*

Chairman : Prof. V. SIFOROV, Academy of Sciences, Moscow.

Presentations :

— Dr. M. ROSEN, N.A.S.A., U. S. A. : « Launching of satellites ».
— Dr. R. ROBERSON, U. S. A. : Attitude control and station keeping ».

Contributions :

— Dr. J. C. SIMON, C.S.F., France : « Un-stabilised satellite radiation ».
— E. G. C. BURT, R.A.E., U. K. : « The influence of cyclic torques on the attitude control of earth-pointing satellites ».
— F. GÉRARDIN, C.F.T.H., France : « Satellite tracking problems ».

Tuesday, September 19, 09.30 a. m. : *Frequency and propagation problems.*

Chairman : Dr R. L. SMITH-ROSE, President of U.R.S.I.

Presentations :

— Dr. R. L. SMITH-ROSE, U.R.S.I., U. K. : « The allocation of radio frequencies for experiments in space communications ».
— Dr. K. RAWER, F.T.Z., F. D. R. : « Propagation influences in space communications »

Contributions :

— Dr. W. R. VINCENT, S.R.I., U. S. A. : « Interference in satellite communication systems ».

— Dr. T. F. ROGERS, M.I.T., U. S. A. : « Propagation effects important in satellite communications ».

Tuesday, September 19, 02.30 p. m. : « *Modulation systems in satellite communications.*

Chairman : Dr. L. JAFFE, N.A.S.A. representative, U. S. A.

Presentation :

— G. BATTAIL, C.N.E.T., France : « General comparative study of modulation systems ».

Contributions :

— W. L. WRIGHT, M.W.T., U. K. : « The choice of the optimum modulation method in active satellite communication systems ».

— C. CARDOT, C.G.E., France : « Feedback frequency modulation as used for satellite communications ».

— Dr. S. C. GHOSE, E.M.I., U. K. : « Digital methods in space communications ».

— Dr. J. R. PIERCE, B.T.L., U. S. A. : « Remarks on modulation methods for satellite communications ».

Wednesday, September 20, 09.30 a. m. : *Ground equipments.*

Chairman : Prof. I. RANZI, Chairman, C.C.I.R. Studu Group IV.

Presentation :

— W. K. VICTOR, J.P.L., U. S. A. : « Ground equipments for satellite communications ».

Contributions :

— A. ROBIEUX, C.G.E., France : « Theoretical study of low noise antennas properties ».

— R. LIGER, S.A.T., France : « The use of directional systems for reducing figure of noise.

— G. BROUSSAUD, C. S. F., France : « Bright band and high stability M.A.S.E.R. ».

— Dr. S. C. GHOSE, E.M.I., U. K. : « The E.M.I. cathode-ray tube decoding devices for digital communication systems ».

Wednesday, September 20, 02.30 p. m. : *Satellite equipments.*
Chairman : Prof. P. AIGRAIN, Paris University.

Presentation :

— Dr. I. M. Ross, B.T.L., U. S. A. : « Reliable components for satellites ».

Contributions :

— J. PICQUENDAR, C.F.T.H., France : « Diverse power supply in satellite ».
— D. G. MAZUR, N.A.S.A., U. S. A. « Satellite component problems ».
— F. DESVIGNES, L.E.P., France : « Photovoltaic solar cells ».

Thursday, September 21, 09.30 a. m. : *Satellite communication systems.*

Chairman : Ing. Gen. R. SUEUR, Deputy Director of C.N.E.T.

Contributions :

— Dr. S. P. BROWN, Advent, U. S. A. : « The Advent Program ».
— R. P. HAVILAND, G.E.Co, U. S. A. : « Intermediate altitude satellite with station keeping ».
— Dr. L. L. GLASER, B.T.L., U. S. A. : « Low altitude random orbit satellites »

Friday, September 22, 09.30 a. m. : *Satellite communication systems* (follow).

Chairman : Cap. C. F. BOOTH, General Post Office, U. K.

Contributions :

— Dr. L. JAFFE, U. S. A. : « N.A.S.A.'s passive stallite program ».
— Dr. W. E. MORROW, M.I.T., U. S. A. : « Communications by orbiting dipoles ».
— Dr. C. M. CRAIN, Rand Co, U. S. A. : « Broadcasting from satellites ».

Friday, September 22, 02.30 p. m. : *Miscellaneous problems in space communicaions.*

Chairman : Ing. Gen. A. ANGOT, President of the French U.R.S.I. National Committee.

Contributions :

— Cap. C. F. Booth, G.P.O., U. K. : « The international planning of satellite communication systems »

— Dr. S. H. Reiger, Rand Co., U. S. A. : « Economics of satellite communication systems ».

— J. R. Brinkley, Pye, U. K. : « The economics of space communications ».

— K. W. Pearson, S.T.L., U. K. : « Transmission problems of satellite communications with special reference to transmission time ».

Provisional list of guests (July 1961)

See p. 26.

C.O.S.P.A.R.

INFORMATION

The following items are abstracts from C.O.S.P.A.R., *Information Bulletin* n° 5, July 1961.

Composition of C.O.S.P.A.R. :

The membership of C.O.S.P.A.R. consists of representatives of National Scientific Institutions (Academies) and of representatives of International Scientific Unions.

The governing body, the Executive Council, consists of seven elected members (the Bureau), the representatives of the International Scientific Unions and, in an advisory capacity, the Chairmen of the Working Groups.

Elected members of the Executive Council (i. e. the Bureau) :

President : Professor H. C. van de Hulst (I. A. U.).

Vice-Presidents : Academician A. A. Blagonravov (U. S. S. R.), Dr. R. W. Porter (U. S. A).

Members : Professor E. Buchar (Czechoslovakia), Professor H. S. W. Massey (U. K.), Professor M. Roy (I. U. T. A. M.), Professor W. Zonn (Poland).

Union Representatives :

International Astronomical Union : Professor H. C. van de HULST (Netherlands).

International Union of Biochemistry : Professor M. FLORKIN (Belgium).

International Union of Biological Sciences : Professor N. D. Ierusalimsky (U. S. S. R.).

International Mathematical Union : Professor B. ROSSER (U. S. A.).

International Union of Theoretical and Applied Mechanics : Professor M. ROY (France).

International Union of Pure and Applied Physics : Professor P. AUGER (France).

International Union and Applied Chemistry : Professor E. MIESCHER (Switzerland).

International Union of Physiological Sciences : Professor U. von EULER (Sweden).

International Scientific Radio Union (U.R.S.I.) : Professor A. C. B. LOVELL (U. K.).

International Union of Geodesy and Geophysics : Professor J. KAPLAN (U. S. A.).

Chairmen of the Working Groups :

Working Group 1 : Professor Mr. A. G. MASSEVITCH (U. S. S. R.).

Working Group 2 : Professor H. BARTELS (German Fed. Rep.).

Working Group 3 : Professor A. P. MITRA (India).

Working Group 4 : Dr. H. KALLMAN-BIJL (U. S. A.).

National Scientific Institutions which are represented in C.O.S.P.A.R. :

Argentina : Consejo Nacional de Investigaciones Cientificas y Technicas, Buenos Aires.

Australia : Academy of Science, Canberra.

Belgium : Académie Royale de Belgique, Brussels — Koninklijke Vlaamse Academie van Belgie, Brussels.

Canada : National Research Council, Ottawa.

Czechoslovakia : Czeskoslovenska Akademie Ved., Prague.

France : Académie des Sciences, Paris.

German Federal Rep. : Deutsche Forschungsgemeinschaft, Bad Godesberg.

India : Ministry of Scientific Research and Cultural Affairs, New Delhi.

Italy : Consiglio Nazionale delle Ricerche, Rome.

Japan : The Science Council of Japan, Tokyo.

Netherlands : Koninklijke Academie van Wetenschappen, Amsterdam.

Norway : Det Norske Videnskaps-Akademi, Oslo.

Poland : Polska Akademia Nauk, Warsaw.

South Africa : South African Council for Scientific and Industrial Research, Pretoria.

U. K. : The Royal Society, London.

U. S. A. : National Academy of Sciences, Washington.

U. S. S. R. : Academy of Sciences of the U. S. S. R., Moscow.

C.O.S.P.A.R. Working Groups :

Working Group I on « Tracking and Telemetering ».
Chairman : Professor Mr. A. G. MASSEVITCH.

Sub-Group « Optical Tracking ».
Chairman : Professor F. WHIPPLE (U. S. A.).

Sub-Group « Radio Tracking ».

Chairman : Mr. J. A. RATCLIFFE (U. K.).

Members : Dr. G. M. TRUSZYNSKI (U. S. A.),
Mr. R. C. PEAVEY (U. S. A.),
Dr. A. SCHACHOVSKOI (U. S. S. R.),
Dr. B. G. PRESSEY (U. K.).
Prof. A. C. B. LOVELL (U. K),
Mr. M. O. ROBINS (U. K.).
Prof. A. P. MITRA (India),
Prof. W. DIEMINGER (W. Germany),
Dr. L. CICHOVITCH (Poland),
Mr. P. F. CHECCACCI (Italy).

Working Group II on « Scientific Experiments ».

Chairman : Prof. J. BARTELS (W. Germany).

Correspondent for Aeronomy and Aurora : Prof. S. M. POLOSKOV (U. S. S. R.).

Correspondent for Ionosphere : Prof. W. J. G. BEYNON (U. K.).

Correspondent for Meteorology : Dr. H. WEXLER (U. S. A.).

Correspondent for Geomagnetism and Cosmic Rays : Prof. N. V. PUSHKOV (U. S. S. R.).

Correspondent for Solar Activity and the Interplanetary Medium : Dr. JH. FRIEDMAN (U. S. A.).

Panel on Synoptic Rocket Soundings : Chairman : Prof. J. BLAMONT (France).

Working Group III on « Data and Publications ».

Chairman : Prof A. P. MITRA (India).

Working Group IV on « C.O.S.P.A.R. International Reference Atmosphere ».

Chairman : DR. H. KALLMAN-BIJL (U. S. A.).

Ad hoc Group for Polar Cap Absorption Experiments (this group has been continued for one year).

Chairman : Dr. D. C. ROSE (Canada).

C.O.S.P.A.R. MEETING AND SYMPOSIUM
(Florence, 7-18 April 1961)

The fourth meeting of the Committee on Space Research took place in Palazzo Pitti, Firenze (Italy) from 7-18 April 1961.

Topics treated during the five-day Symposium, which was organized jointly with the Consiglio Nazionale delle Ricerche, were :

— Radio and Optical Tracking,
— Magnetic Observations by Rockets and Satellites,
— Telemetery and Data Recovery
— Special Events such as July 1959 and November 1960,
— Recent Results from Instrumented Satellite and Space Craft,
— International Reference Atmosphere,
— Scientific Research by Means of Small Sounding Rockets.

One day was devoted to reports from the National Scientific Institutions represented in C.O.S.P.A.R. and from the International Scientific Unions.

The great interest shown in this Symposium was reflected in the number of participants which exceeded 290, from 27 countries. A number of 109 scientific papers was presented, partly in simultaneous sessions. Several sessions were designed to provide the basic material for the discussions in the working groups. The proceedings of the Symposium will be published by the North Holland Publishing Company.

Sessions of the full C.O.S.P.A.R., its Executive Council and its various Working Groups have occupied several days preceeding and following the Symposium sessions.

During the full C.O.S.P.A.R. meeting the close cooperation of C.O.S.P.A.R. with the International Scientific Unions as well as with other international organizations was reconfirmed and many detailed arrangements were discussed and concluded. For instance, good progress was made toward reducing the number of telegraphic code systems for messages on satellite orbits (now 7 in number) to a single world-wide system. Argentina and India were added as new national members, bringing the national representation to 18.

Space radio problems

I.U.C.A.F. starts its work.

The Inter-Union Committee on Frequency Allocations for Radio Astronomy and Space Science (I.U.C.A.F.) has already been reported.

A working party of this Committee has been established and has met in the office of U.R.S.I. in Brussels on 27-28 March 1961.

The relevant sections of the « Radio Regulations » of the I.T.U. were surveyed and the allocations for radio astronomy and for space research made at Geneva were discussed. In the Radio Regulations, Geneva 1959, the frequency band 136-137 Mc/s is allocated jointly to « Space, Fixed, Mobile and Earth-Space ». It was agreed to press strongly for an exclusive allocation to space research of the band 136-137 Mc/s, which is now in use at a large number of earth satellite tracking stations throughout the world.

A recommendation to this effect will be submitted to the C.C.I.R., to the I.T.U. and to the national frequency allocation authorities.

Project West Ford, formerly termed « Needles », a possible scheme of providing many channels of telecommunication by the scattering properties of billions of small needles in satellite orbits, was discussed. The first test belt is scheduled to be launched very soon at a date not yet disclosed. A committee, formed by the Space Science Board of National Academy of Sciences of U. S. A., has invited accurate observations of the interference caused both to optical and to radio astronomy. The working party urged full support of these observations.

The full I.U.C.A.F. meeting will take place in London on the 19th and 20th of October 1961.

C.O.S.P.A.R. Action.

During the C.O.S.P.A.R. meeting in Florence, April 1961, Working Group 1 reviewed the situation with respect to frequency allocations and the draft recommendations presented by I.U.C.A.F.

The following resolutions were drawn up and were unanimously accepted by the full C.O.S.P.A.R.

Resolution 11

C.O.S.P.A.R. emphasizes the need for allocation of frequencies for Space Research quite apart from those required for commercial communications by the means of satellites.

Resolution 12

C.O.S.P.A.R. re-affirms the needs for frequency allocations for Space Research previously presented by C.O.S.P.A.R. to the conference of I.T.U. in 1959 at Geneva. It is noted that these needs were only partially fulfilled at that conference, and it is urged that all possible steps be taken at the forthcoming I.T.U. conference in 1963 to obtain satisfaction.

Resolution 13

C.O.S.P.A.R. supports the draft recommendation of I.U.C.A.F. to the effect that the band of frequencies 136-137 Mc/s should be allocated exclusively for the use of Space Research, and that

transmitters used for space research on these frequencies should not radiate harmful interference on their third harmonic which is within the band used for radio astronomy near 408 n/cs. In addition C.O.S.P.A.R. reecommends that the I.U.C.A.F. be requested to modify paragraph 3 of their recommendation to read as follows : « until the band of frequencies (136-137 Mc/s) is completely cleared national administrations should arrange their services in such a way as to afford the maximum practicable protection for satellite tracking stations using this band ».

Resolution 14

Considering :

(1) that Faraday and Doppler effects provide data which can be analyzed to give integrated electron content of the ionosphere provided that the position of the satellite is accurately known ;

(2) that the analysis of the data obtained may demand a positional accuracy of $\pm$ 2 km, in order to ensure a satisfactory accuracy in the deduction of the electron content ;

(3) that past experience has shown that the near-circular orbit and the phase-coherent transmissions on both 54 and 324 Mc/s from « Transit » satellites are very well suited for differential Doppler measurements and that the Doppler tracking network provides positional information accurate to about $\pm$ 1 km.

(4) that tracking by the Minitrack network on a frequency in the range 136-137 Mc/s is able to provide the accuracy required.

C.O.S.P.A.R. recommends.

(1) that the U. S. A. authorities concerned be made aware of the great interest of ionospheric research groups in many countries in further « Transit » satellites of high orbital inclination (*i.e.* greater than 50°) transmitting on both 45 and 324 Mc/s which can be tracked very accurately, and that they should make available to all bona fide experimenters accurate orbital information preferably not later than one month after the date to which it applies ;

(2) that further « Ionosphere Beacon » satellites, in addition to those already planned, which are also equipped with a tracking beacon on the Minitrack frequency should be launched and that accurate orbital elements should be made available to all bona fide experimenters preferably within one month after the date to which they apply.

Advance information about space experiments

The Canadian topside sounder satellite (1), by J. H. Chapman.

This report describes the satellite being constructed in Canada for radio sounding of the ionosphere. The purpose of the satellite are :

(*a*) to measure the electron density distribution in the ionosphere above the F2 layer maximum (300 to 1000 km).

(*b*) to study for a period of a year the variations of electron density distribution with time of day, with latitude, under varying magnetic and auroral conditions, and with particular emphasis on high latitude effects.

(*c*) to determine electron densities in the vicinity of the satellite by means of galactic noise measurements, and to make related observations of physical phenomena.

The ionosphere sounder is similar in operation to the sweep sounders used in ground stations. Details are as follows :

Transmitter :

Frequency sweep	1.8 to 11.5 Mc/s
Sweep duration	12 seconds
Peak pulse power radiated	20 watts
Pulse length	100 microseconds
Pulse recurrence frequency	67 per second.

Receiver :

Frequency sweep	0.5 to 12.0 Mc/s.

There will be two telemetry channels. A low power beacon will be on during the operating life of the satellite, primarily for tracking purposes. It will also be used part of the time for data transmission. Details are as follows :

(1) Prepared in pursuance of Nice Resolution n° 14.

Beacon Transmitter :

Frequency	136.590 Mc/s
Transmitter power	0.25 watts
Modulation	Phase modulation
Sub-carrier Frequencies	3.9, 7.35, 10.5, 14.5 kc/s

A higher power telemetry transmitter will be used for transmitting sounding data to earth.

Telemetry Transmitter :

Frequency	136.080 Mc/s
Transmitter power	2 watts
Modulation	Frequency modulation

Normally the beacon, used for radio tracking, will be the only transmitter operating. The sounding programme will be initiated from the ground on command. On receipt of the command, both the sounding transmitter and the high power telemetry transmitter will be switched on The sounder will sweep through the band for 12 minutes, and will then be shut off automatically.

Secondary experiments in the satellite will be measurements of cosmic noise, and energetic particles. These data will be transmitted to ground telemetry stations over the beacon data link.

The satellite is to be launched into orbit by a launching rocket of the U. S. A. during 1962. It is expected that the satellite will be placed in a circular orbit at an altitude of 1000 km, with an inclination of 80° and with a period of 105 minutes.

O. M. M.

EXPLORATION DE L'ATMOSPHÈRE ET DES DIFFÉRENTS PHÉNOMÈNES ATMOSPHÉRIQUES A L'AIDE DE SATELLITES ARTIFICIELS

England text, p. 43

En 1959, le Comité Exécutif de l'O.M.M. décida de former un Groupe d'Experts pour les satellites artificiels, avec le mandat suivant :

a) se tenir au courant des utilisations possibles de satellites artificiels pour des buts météorologiques ;

b) formuler des suggestions sur la meilleure manière dont l'O.M.M. pourrait aider ces activités.

Ce groupe fut réétabli en 1960 en vertu de la Résolution 15 qui figure à l'Annexe I.

Par ailleurs, en 1959 également, le Congrès de l'O.M.M. définit comme suit la politique de l'O.M.M. relativement à l'utilisation des satellites artificiels :

(i) Encourager le développement et l'emploi des satellites artificiels en tant que moyen pour se procurer des données météorologiques valables ;

(ii) Collaborer, selon les besoins, avec les Nations Unies, les autres Agences spécialisées et les Organisations Scientifiques, et particulièrement le Comité pour la Recherche Spatiale, dans les programmes relatifs aux satellites artificiels et susceptibles de conduire à des résultats intéressants pour les météorologistes ou bien pour lesquels l'avis des météorologistes pourrait être utile.

Le Groupe tint une réunion importante en février 1961 à Washington . L'Annexe II fournit quelques extraits du rapport de cette réunion. Ce rapport fut examiné par le Comité Exécutif de l'O.M.M. qui adopta la Résolution 10 figurant à l'Annexe III.

Tous commentaires et suggestions concernant les activités de l'O.M.M. dans ce domaine, et plus particulièrement ceux des Membres du Comité Inter-Unions de Radiométéorologie et du Comité de la Recherche Radioélectrique dans l'Espace, peuvent être tranmis au Secrétaire Général de l'U.R.S.I. qui les fera parvenir aux organes intéressés de l'Union et à l'O.M.M.

Voir Annexes p. 45.

W.M.O.

INVESTIGATION OF THE ATMOSPHERE AND OF THE VARIOUS ATMOSPHERIC PHENOMENA BY MEANS OF ARTIFICIAL SATELLITES

In 1959 the Executive Committee of W.M.O. decided to set up a Panel of Experts on Artificial Satellites with the following terms of reference :

(*a*) To keep a continuing review of the possible uses of artificial satellites for meteorological purposes ;

(*b*) To make suggestions as to how W.M.O. can best assist in these activities.

This Panel was re-established in 1960 by Resolution 15 given under Appendix I.

On the other hand, also in 1959, the W.M.O. Congress decided that the policy of W.M.O. concerning the use of artificial satellites should be :

(i) To encourage the development and use of artificial satellites as a means of providing valuable meteorological data ;

(ii) To collaborate as required with the United Nation, other specialized Agencies and Scientific Organizations, in particular the Committee for Space Research, in artificial satellite programmes which may lead to results of interest to meteorologist or on which the advice of meteorologists may be useful.

The Panel had an important session in Washington in February. 1961. Appendix II gives some abstracts from the report of this session. The report was considered by the Executive Committee of W.M.O. which adopted Resolution 10 given under Appendix III.

Any comments and suggestions with regard to the activities of W.M.O. in this field would be welcome by U.R.S.I., particularly from the members of the Inter-Union Committee on Radio Meteorology and of the Committee on Space Radio Research. Such comments and suggestions should be sent to the Secretary General of U.R.S.I. who will forward them to the U.R.S.I. interested bodies and to W.M.O.

APPENDIX I

Investigation of the atmosphere and various atmospheric phenomena by means of artificial satellites

(Resolution 15)

The Executive Committee.

Noting Resolution 28 (*Cg*-III) and Resolution 6 (EC-XI);

Decides :

(1) To maintain in being the Panel of Experts on Artificial Satellites with the same membership as before, namely :

V. A. Bugaev (U. S. S. R.),
H. Wexler (U. S. A.),
W. J. Gibbs (representing C.S.M.),
G. D. Robinson (representing CAe);

(2) To revise the terms of reference of the panel as follows :

(*a*) To keep a continuing review of the possible uses of artificial satellites for meteorological purposes;

(*b*) To make suggestions as to how the World Meteorological Organization can best assist in these activities;

(*c*) To assist in co-ordinating the activities of working groups which may be established by technical commissions within this field;

(*d*) To present a progress report to the next session of the Executive Committee;

Requests the Secretary General,

(1) To continue to assist the panel, as required, in its work;

(2) To collaborate, as required, with the United Nations, other specialized agencies and scientific organizations in artificial satellite programmes which may lead to results of interest to meteorologists or on which the advice of meteorologists may be useful;

(3) To keep Members informed of developments in this field.

APPENDIX II

Extracts from Report of the Second Meeting of the Panel of Experts on Artificial Satellites

1. — The meeting was held in the U. S. Weather Bureau, Washington, D.C., U. S. A., 7th to 10th February 1961.

Members present :

Mr. W. J. GIBBS (C.S.M.).

Dr. G. D. ROBINSON (CAe).

Dr. H. WEXLER (U. S. A.).

Assisted by :

Dr. K. LANGLO (W.M.O. Secretariat).

Dr. G. D. ROBINSON was elected Chairman of the meeting.

INTRODUCTION

2. — The first meeting of the Panel was held in November 1959. Since then two meteorological satellites, TIROS I and II, have been launched, while EXPLORER VII, in orbit at the time of that meeting, has continued to transmit data on solar and terrestrial radiation. At our second meeting we have been presented with the results of research on the TIROS and EXPLORER transmissions, we have heard of applications of TIROS data in operational analysis and forecasting, and we have been told of firm plans for the launching of a family of more advanced meteorological satellites for research and development purposes and of more tentative planning of a system of operational meteorological satellites.

3. — These developments are due to the initiative of the U. S. A. We understand that insofar as data from these satellites can be used in current analysis and forecasting — and we believe that many of them can be so used if proper caution is exercised — they will be made freely available, as indeed they have been to date. Furthermore, copies of satellite data will be available for research purposes from World Data Centre A.

DEVELOPMENTS SINCE THE LAST SESSION OF THE PANEL

TIROS I and II.

4. — The first television cloud observing satellite, TIROS I, launched on April 1, 1960, produced nearly 23,000 pictures of the earth's surface during its 78 days of useful life, of which more than 60 % are good-quality cloud-photographs, useful in meteorological analysis, prediction and research. These pictures revealed almost immediately two important resuts : circular cloud patterns of diameters up to 1500 km and large areas composed of many crescent-or doughnut-shaped cloud cells of diameters 50 to 80 km. Many of the large circular clouds have a marked banded structure and are associated with cyclonic storms. No two cyclonic cloud patterns are exactly alike. The smaller cellular clouds are apparently of convective origin and are too large to be seen as a whole by the human eye and too small to be recognized on conventional meteorological charts. The convective cells revealed by these 50-80 km wide clouds probably play an important role in transferring heat, water vapour and momentum from the surface to the lower layers of the atmosphere.

5. — TIROS I has also revealed additional interesting information : spiral cloud bands of a tropical cyclone north of New Zealand, cirrus streamers associated with the jet stream over the southern Andes, double vortex clouds in cyclones which apparently have only one low-pressure centre, cumulus cloud « streets » in the tropics, a single long thin cloud about eight km wide and several hundred kilometres long east of Florida (probably an airplane contrail) and its reverse — a long, thin *cloudless* streak embedded in an otherwise continuous cloud cover near Madagascar, a broken pattern of sea ice in the Gulf of St. Lawrence and snow fields in the Himalayan Mountains and in the Alps. A series of photographs obtained from five orbits over the southern Indian Ocean in late April 1960 enabled construction of a synoptic cloud chart for that area, composed of four main cyclonic centres. This situation was included as an addendum in our previous report. One of these storms later moved into southern Australia, giving a prolonged period of precipitation.

6. — The TIROS II meteorological satellite containing two television cameras and the family of radiation experiments described below was placed into orbit on November 23, 1960. By January 15, 1961, 12,571 wide angle pictures and 894 narrow angle pictures were obtained. While the wide angle pictures are not as clear as those of TIROS I they are still quite useful ; the narrow angle pictures are of excellent quality.

7. — Radiation data were also obtained for more than 400 orbits. A radiometer contains a cluster of five sensors, their optical axes inclined 45 degrees to the spin axis of the satellite. Each sensor has a 5-degree field of view covering an area of about 50 × 50 km. The spin and movement of TIROS along its orbit provides the scanning motion. Channels are sensitive to the following spectral bands.

(1) 6 to 6.5 microns. This gives average temperature of the top layer of the atmosphere containing about 0.3 mm precipitable water.

(2) 8 to 12 microns. This gives approximate temperature of the earth's surface or of the top of the highest cloud of appreciable thickness.

(3) 0.2 to 6 microns. This measures the energy of reflected solar radiation.

(4) 8 to 30 microns. This measures the energy of the terrestrial radiation.

(5) 0.55 to 0.75 microns. This is the region of maximum sensitivity of the television camera.

A limited amount of data has been reduced. Samples taken in the atmospheric water vapour « window » between 8 and 12 microns over the United States shows apparent black body temperatures ranging between 210 and 250 degrees K over cloudy areas and about 280 degrees K over cloudless regions.

8. — The 6 to 6.5 micron band shows apparent black body temperature between 220 and 250 degrees K also recorded over the United States on the day of launching of TIROS II. On the same day, data from an area between Australia and New Zealand were reduced. A map shows the radiation pattern resulting from the measurement in the 8 to 12 micron window. Low

temperatures of 240 degrees K suggest the presence of high clouds. Maximum temperatures of more than 280 degrees K, recorded north of New Zealand are somewhat loss than the ocean temperatures in this region.

9. — A second radiometer on TIROS II, with much lower resolution, gives heat balance information over an area within the field of view of the wide angle television camera. One black and one white thermistor, each mounted in the apex of a highly reflective cone, serve as detectors. Measurements from the black detector fall into the expected range. The white detector, however, seems to act as a medium gray sensor since the temperature differences between both sensors are lower than expected. Cloudy and clear areas inferred from the surface, weather maps seem to be in agreement with radiometer data.

EXPLORER VII.

10. — EXPLORER VII was launched on 13 October 1959 and is still transmitting information. It carries two sensors designed to absorb mainly solar and mainly terrestrial radiation respectively; from their telemetered temperatures the reflected solar radiation and the terrestrial radiation from an area of the earth 800 to 1600 km in diameter are calculable in principle. We were shown the results of some calculations. They included synoptic maps of the effective radiative temperature of a large area of North America, which showed a clear association with high and low pressure systems on weather maps, and preliminary estimates of latitude variation of outgoing terrestrial radiation for periods of one week in December and April, which were rather higher than previously accepted estimates.

11. — It is expected that EXPLORER VII data will be made generally available, possibly in the form of magnetic tape. This will probably contain sensor temperatures with all other information necessary for the computation of radiation values.

PROPOSALS FOR FUTURE METEOROLOGICAL SATELLITES

12. — We were informed of plans for future launchings of meteorological satellites for research and development purposes. The

TABLE I

U.S.A. meteorological satellite programme

	1961	1962	1963	1964 *
Launchings	1 or 2 TIROS	2 NIMBUS	2 NIMBUS	2 AEROS
Orbit	Inclined-50°	Retrograde-80° (Quasi-polar)	Retrograde-80° (Quasi-polar)	Equatorial
Altitude	700 km	1100 km	1100 km	36 000 km
Orientation	Space, Spin stabilized	Earth stabilized	Earth stabilized	Earth stabilized
Measurements	1. Cloud cover (vidicon)	1. Cloud cover (vidicon, electrostatic tape)	1. Cloud cover	1. Cloud cover (camera with varifocal lens)
	2. Scanning and non-scanning solar and terrestrial radiation	2. Scanning and non-scanning solar and terrestrial radiation	2. Solar and terrestrial radiation	
		3. Other radiation measurements	3. Other radiation measurements	
			4. Other developments (radar, spectrometer, image orthicon, sferics, etc.)	
			5. On-board analysis	

* Preliminary plans for 1964 and subsequent years include one polar-orbiting satellite.

programme to be implemented in the U. S. A. is summarized in Table I ; the proposals for 1964 are in the planning stage, but are not finally approved.

13. — We were also notified that spectroscopic and total absorption experiments to measure atmospheric ozone would be mounted on the second satellite in the U. K.-U. S. A. Scout Satellite Project (Scout U. K. 2) with a probable launching data early in 1963. Orbit details : Inclined 55°, perigee 450 km, apogee 1600 km, spin stabilized.

14. — We learned of no firm plans for the use of operational meteorological satellites on a continuing basis. However, we understand that a study of such a system, in some detail, is in progress in the U. S. A. and that approval will be sought for its implementation.

15. — No information regarding research or operational satellites was received from other countries.

Availability of data

16. — We were informed of the steps being taken to make freely available for study the data obtained by satellites TIROS I and II and EXPLORER VII.

17. — The cloud picture transmissions from the TIROS satellites received at the read-out stations were displayed on a TV screen, and simultaneously recorded on magnetic tape. A 35 mm camera photographed the TV screen, producing a black and white negative of each television picture. This master negative, from which copies can be made for distribution and analysis, will be stored permanently at the U. S. Weather Bureau's National Weather Records Center (N.W.R.C.), Asheville, North Carolina, U. S. A.

18. — A catalogue now in preparation will contain a track map for each picture sequence and tabulated information on orbit pass number, date, starting time of the sequence, and brief remarks on visible landmarks and cloud features. This catalogue will be published as a number in the U. S. Weather Bureau's *Key to Meteorological Records Documentation* series and will then be available to all interested through the United States Superintendent of Documents, Washington 25, D.C., U. S. A. Those who

wish to obtain copies of the films, will be able to do so, from the N.W.R.C., in the form of 35 mm film positive transparencies for projection or 35 mm duplication negatives from which opaque prints can be mate. The film will be stored on 100 foot rolls, each containing about 800 frames, and it will be necessary to order one or more complete rolls. It will not be possible to provide individual frames, enlargements, or other picture formats.

19. — Each picture bears an orbit pass number, a frame number, and indications of camera used (wide- or narrow-angle) and mode of transmission (direct or from tape), but no auxiliarly information on orientation with respect to the earth's surface. A number of the wide-angle camera pictures have been selected for photogrammetric analysis. With the aid of this analysis an estimate of the camera orientation for the selected pictures is obtained. Where camera orientation information is known with sufficient precision, grids will be constructed showing geographic co-ordinates. Another set of 35 mm transparency film strips, negatives and positives, will be produced showing the cloud pictures with grids showing geographic co-ordinates and appropriate labels superimposed thereon. When these become available, copies may be obtained from the N.W.R.C. in 100 foot rolls.

20. — After completion of the procesisng of the radiation data from the TIROS satellite, these also will be made available through the N.W.R.C. A format for presentation of these data has not been determined.

21. — We were informed that certain difficulties met with in reduction of the measurements transmitted from the radiation balance experiment in EXPLORER VII had now been largely overcome, and it was the intention to make the processed or partially processed data available through the N.W.R.C. in a format not yet determined.

Operational aspects

Use of data from TIROS I and TIROS II in routine analysis and forecasting.

22. — The TIROS satellites were placed into orbit primarily for research purpose. They provide an entirely new method of

obtaining types of observations of cloud distribution not available by any other means. Many cloud photographs from TIROS I contained cloud patterns which were evidently associated with cyclonic circulations, and others showed bands of cloud obviously linked with fronts. TIROS II cloud photographs, althouth the wide-angle camera was slightly out of focus, also contained patterns which in many cases could be associated with synoptic features.

23. — A few plain language statements, based on TIROS I photographs, were issued from the U. S. Meteorological Satellite Laboratory. Following the experience gained with TIROS I, nephanalyses were prepared for 371 of the 576 programmed orbits of TIROS II between November 23, 1960 and February 2, 1961. These nephanalyses indicated the satellite picture boundary and the boundaries of cloud areas. Plain language indication was also given of features such as vortices, spiral bands, etc., and the nature of the cloud areas was indicated.

24. — Nephanalyses were transmitted over facsimile circuits or by coded statement over teletype circuits, about 6 hours after orbit time.

25. — These nephanalyses were widely disseminated in the U. S., to meteorological offices, airline companies, power companies, and T.V. and radio stations. They were also broadcast by radio-facsimile from a number of U. S. Navy radio stations, and were intercepted by some countries. The coded messages were sent by teletype to the International Antarctic Analysis Centre in Melbourne, and were therefore available also to the Australian Bureau of Meteorology.

26. — Preliminary reports have been received from a considerable number of stations in the U. S. and from the I.A.A.C. and Australian Bureau of Meteorology regarding operational use of TIROS II nephanalyses. These reports agree that some nephanalyses are of definite assistance in synoptic analysis and forecasting, particularly when the cloud is arranged in patterns which strongly suggest vortices, frontal systems or convergence zones. Other nephanalyses have been difficult to interpret, probably as a result of lack of experience of the recipient. On some occasions there were inconsistencies between nephanalyses and simul-

taneous cloud observations from the ground ; this may have been due to the fact that wide angle camera on TIROS II was slightly out of focus.

27. — Examples of operational use of nephanalyses by U. S. meteorologists were :

(i) 14 January 1961, in the vicinity of 5° N 165° W where nephanalyses were used to determine an area of significant weather for aviation forecasting and briefing.

(ii) 30 November 1960, in the Central Mediterranean, where revised frontal analysis was used in aircraft observations and for briefing aircrews.

(iii) 30 November 1960, in eastern U. A. and the western Atlantic when a frontal position off the eastern coast was confirmed by nephanalyses.

(iv) 1-9 December 1960, over eastern U. S. A. and the western Atlantic when nephanalyses were used for cloud forecasting for air operations and permitted extension of the analysis to areas where conventional data ware sparse.

(v) 30 November 1960, off the western coast of U. S. A., when nephanalyses resulted in the modification of an analysis from two fronts to three fronts or instability lines.

(vi) 2 December 1960, off the California coast, when nephanalysis extended a frontal analysis to a sparse data area.

(vii) 30 January 1961, along the peninsula of Baja, California, when nephanalysis showed cloud cover beyond that indicated by regular observational procedures.

28. — 191 nephanalyses were received in Australia between 8 December and 12 January. Of these 134 were plotted, the remainder being remote from the Australian area if interest. Many of these analyses were over the oceanic areas surrounding the continent. The nephanalyses were valuable in increasing confidence in the conventional analysis.

29. — Some particular case where TIROS II nephanalyses were operationally useful in Australia included those for :

(i) 28 December 1960 when nephanalyses over the Southern Ocean, south of Australia, were of material benefit in deter-

mining the situation over this region and in forecasting a cool change which followed heatwave conditions over SE Australia.

(ii) 3 January 1961, when nephanalyses over the Coral Sea showed areas of heavy overcast associated with the development of a weak tropical cyclone.

30. — There is no doubt that TIROS cloud photographs, gridded with geographical co-ordinates and available within a few hours of observation time, are of assistance in analysis and forecasting, especially if they are available over areas normally deficient in meteorological observations, such as large oceanic areas.

31. — A W.M.O. Technical Note on the interpretation of satellite data would be of geat value and we are informed that the U.S.W.B. is willing to prepare such a Technical Note.

32. — There is also a need for further investigation :

(*a*) To determine the resolution, positional accuracy and fidelity of satellite cloud photographs ;

(*b*) To determine the type of cloud patterns associated with various stages of development of synoptic features such as highs, lows, troughs, ridges, jet streams, and with various states of atmospheric stability (see paras. 49-51).

ACQUISITION AND DISSEMINATION OF DATA FROM NIMBUS METEOROLOGICAL SATELLITE

33. — Because of its quasi-polar orbit and earth orientated stabilization system, the NIMBUS satellite should be capable of collecting observations over the entire surface of the earth.

34. — The U. S. A. is now constructing a command and data acquisition station in Fairbanks, Alaska, for use with the first NIMBUS satellite. There is a possibility that a second station will be established on the east coast of the United States. During the period on each orbit when the satellite is within radio range of the ground station, the observational data obtained during the entire previous one or two orbits will be transmitted at high speed to the ground station where it is recorded. At the same time instructions will be radioed to the satellite to control its data collection during subsequent orbits.

35. — The number and location of command and data acquisition stations determine how much of the global data can actually be received on the ground. If only a single station, located at Fairbanks, Alaska, is used, then a sector including South America, Africa, Western Europe, North and South Atlantic would be missed on the south-bound (night-time) passes of the satellite and Eastern Asia, Australasia, Japan, most of the North Pacific and the western half of the South Pacific would be missed on the north-bound (day-time) passes. With the addition of a station located on the east coast of the United States, much of the South Atlantic, Africa, and a portion of Europe would still be missed on the south-bound passes; a section of the North and South Pacific, about 60° of longitude wide, would be missed on the north-bound passes. A third station, for example in Northwestern Europe, would permit the reception of data from the entire earth. If a read-out station were established poleward of 80° latitude, it would permit reception of data from all orbits of polar-orbiting satellites.

Processing of data for operational use

36. — Plans are well under way to permit the use in meteorological operations of cloud pictures obtained by the NIMBUS satellite. The pictures will be obtained over the sunlit portion of the earth by television type cameras. There is also a possibility that data from one of the scanning radiometers might be used to determine the gross cloud patterns over the dark side of the earth. This will require development of suitable rapid processing equipment to permit the use of these data operationally.

37. — It is expected that a wide band communications link will be used to transmit the television signals from the ground receiving stations to the National Meteorological Centre located at Suitland, Md., U. S. A. At this point the signals will be rapidly transformed into pictures and high speed computing equipment used to prepare superimposed latitude and longitude grid lines. Meteorologists at this Centre will analyze the picture information, incorporating the results into the standard meteorological analysis as well as preparing results in abbreviated form for transmission to other users. A small team of meteorologists located at the ground receiving stations will assist in providing quality control

and in emergencies will produce nephanalyses in the same manner as for the TIROS satellites. On these occasions the nephanalyses will be transmitted from the ground receiving stations, using standard facsimile and teletype circuits.

Dissemination of NIMBUS data on an operational basis

38. — Within the U. S. A. it is expected that facsimile circuits will be the main means for the transmission to field forecast groups of analyzed cloud picture data. It is hoped that higher quality facsimile equipment than that normally used for transmission of weather maps can be installed at forecast centres. This would permit the transmission of selected cloud pictures in addition to nephanalyses to these stations.

39. — Nephanalyses will be available to other countries having the necessary radio-facsimile equipment. Realizing the limited availability of facsimile circuits on an international basis, it is also planned to prepare coded reports which could be transmitted by teletype. Such dissemination requires establishement of appropriate codes, headings, and communications facilities (see paras. 41-42).

Forms of dissemination of cloud data

40. — We recognize the urgent need for establishing standardized formats for the dissemination of cloud data expected from the NIMBUS satellite to be launched in 1962 so that advantage can be taken of this unique meteorological information and recommend the following forms for the dissemination of this data, listed in order of desirability.

(*a*) *Photo-mosaics, with analytical notes and geographical grids superimposed.* — The transmission of this form would require considerable band width. The detail included in the received pictures would be in direct proportion to the band width used. To retain all of the detail contained in the original observations, a bandwidth of 150 kc per second and a transmission time of 2 hours would be required to transmit pictures from one orbit. Since the orbital period of the NIMBUS satellite will be approximately 2 hours, continuous use of such a line would be required

if pictures for the entire earth were to be transmitted on a current basis.

(*b*) *Nephanalyses.* — In this format the cloud information would be presented in a form similar to that used in conjunction with the TIROS satellite. Cloud areas would be presented on a standard base map with appropriate symbols used to indicate special cloud features and cloud type. A standard weather facsimile circuit of 3 kc per second bandwidth would be used. Transmission time for the analysis of daytime pictures obtained on each orbit would of course depend upon the size of the map used, and the amount of detail it is desired to transmit. It is estimated that a minimum time of 40 minutes would be desirable if data were to be transmitted for the entire sunlit portion of each orbit. A reduction in this time could be obtained if only selected data were transmitted on a regional basis.

(*c*) *Teletype transmission of coded analyses.* — Appropriate codes similar to those used for teletype transmission of weather maps can be used to encode the nephanalyses for transmission by teletype. Again the amount of detail desired as well as extent of area coverage required will determine the transmission time for the data resulting from each orbit. Based on experience in using cloud pictures obtained from TIROS satellites, it is estimated that up to approximately 20 minutes at 60 words per minute would be required for the transmission of coded analyses based on the entire sunlit portion of one orbit.

41. — In paragraph 40 we state our preference as to types of pictorial data which should be disseminated internationally (*a*) gridded photographs, (*b*) nephanalyses via facsimile and (*c*) nephanalyses in coded form supplemented by narrative description. We have also noted the plans to launch TIROS III during 1961 and to launch NIMBUS I during 1962. The latter will cause an even greater communications load because of the increased amount of data available.

42. — We realize that the existing communications facilities do not permit routine dissemination internationally of data in our first two preferred forms. Nevertheless we feel that the problems should be considered now, so that the W.M.O. can develop a long-term solution which would permit their distribution.

Radio frequency allocation for transmissions of operational meteorological satellites

43. — In our previous report we suggested early consideration of steps to ensure adequate allocation of radio frequencies for the transmission from satellites of data for operational use, and drew attention to the I.T.U. Extraordinary Meeting in 1963. We are advised that this problem is still an urgent one.

Research aspects

44. — We discussed some aspects of the research made possible and desirable in view of the data already obtained from satellites and also directions in which further research seems possible and desirable. We summarize our discussion in the following paragraphs.

Interpretation of cloud photographs

45. — The cloud patterns observed by TIROS contain a large amount of information and only a small fraction of this is being extracted by meteorologists. The amazing complex of linear, circular, spiral and cellular patterns over a wide range of dimensions is a striking manifestation of atmospheric motions and processes which would otherwise go on unnoticed. Interpretation of these cloud patterns would be assisted by :

(*a*) Increased documentation of cloud patterns observed by satellite by taking auxiliary observations and photographs of the same cloud system from ground stations, aircraft, rockets, etc., and by taking additional conventional meteorological observations and soundings in the same area.

(*b*) Comparison of cloud pictures with meteorological features, extended to many geographical areas and covering a large variety of synoptic pattern for all seasons.

(*c*) Encouragement of theoretical analysis of convection based on earlier work by Rayleigh, Jeffreys, Pellew and Southwell, Malkus and Veronis, and Kuo. Here problems of extraordinary mathematical difficulty are encountered but the existence of widespread organized cloud patterns now being revealed by satellites should serve to stimulate theoretical progress.

(*d*) Intensification of laboratory exploration of convection started by Bénard, Avsec, Mal and others.

46. — The study of satellite cloud pictures in combination with synoptic charts, laboratory experiments and theoretical analysis should stimulate investigation of the smaller-scale phenomena as did that of synoptic charts, planetary wave-theory and dishpan experiments for the larger-scale wave patterns.

Radiation measurements from satellites

47. — Everyone recognizes that without external energy input atmospheric motions would soon run down and thus acknowledges the necessity for measuring radiation fluxes to and from planet Earth. Now that earth-circling satellites have begun to produce solar and terrestrial radiation measurements in sufficient quantity, ways must be found to use the data.

48. — As mentioned in paragraph 10, patterns of outgoing radiation from the atmosphere and earth have been plotted which bear remarkable similarity to anticyclones and cyclones in dimension and motion ; this is caused primarily by the presence or lack of cloud sheets associated with these systems.

49. — As additional radiation data, especially from polar-orbiting satellites become available, it appears that the following investigations will be valuable :

(*a*) Mapping areas of net radiant energy accumulation and noting associations with changes in potential energy and large-scale processes such as anticyclonic and cyclonic development.

(*b*) Measuring the radiation balance of selected zones.

(*c*) Keeping track of long-term variations in the heat balance of the planet Earth and the accompanying variations in earth albedo. Such investigations would make a unique contribution to knowledge of the general circulation and consequently add to our understanding of the causes of long-term changes in weather and climate.

Ozone distribution

50. — We have been informed of two proposals for measuring the amount and distribution of ozone in the atmosphere. The

first, to be mounted on SCUOT UK 2 uses the measurements of the solar radiation in the ultraviolet ozone band as the satellite passes into and out of the earth's shadow. Total absorption and spectral distribution will be measured. The method is expected to be most effective for heights above the ozone maximum. The second involves examination of the scattered solar radiation. These projects could result in a greatly increased knowledge of the variation of ozone content in time and space, with application to the study of radiative transfer of energy and of the general circulation.

New types of measurement

51. — Work is progressing on techniques to obtain new types of measurements, such as precipitation detection by radar, vertical temperature structure in the stratosphere and high troposphere by infrared spectrometer, and ozone distribution by ultraviolet spectrometer.

52. — Further types of measurements from satellites are desired. For example, surface pressure could be measured if a technique could be divised to determine the total mass of the atmospheric column beneath the satellite. An accuracy of at least 5 millibars is considered to be necessary for such a measurement to be useful.

53. — A means of determining winds at a number of levels on a global basis would contribute significantly to the value of satellite observations. Such measurements might be made by using the satellite to locate and record the positions of a number of constant level balloons. In addition to the tremendous engineering problems involved in such a system, full international co-operation would be required for the flight of the balloons.

54. — To advance the field of meteorological satellite observations, scientists in all countries should be encouraged to develop techniques for making new or improved measurements from this unique observing platform. Through international co-operation, arrangements could probably be made for the engineering development of suggestions of merit even though the individual scientist lacked the facilities for such development.

ACKNOWLEDGEMENTS

55. — We were greatly assisted in our deliberations by the advice of Mr. David S. Johnson, Mr. G. D. Cartwright and Mr. A. W. Johnson of the U. S. Weather Bureau. Before our formal meeting was convened we were briefed on the present state of research on the data of EXPLORER VII by Professor V. Suomi of the University of Wisconsin, on the equipment of TIROS II by Dr. R. A. Hanel of N.A.S.A., on current and planned research on TIROS and NIMBUS data by Dr. S. Fritz, Mr. David S. Johnson and Dr. David Q. Wark of the U. S. Weather Bureau, and on the future meteorological satellite programme of the U. S. A. by Dr. Morris Tepper of N.A.S.A. We are greatly indebted to these gentlemen.

56. — Our meetings were conducted in a conference room of the U. S. Weather Bureau by courtesy of Dr. F. W. Reichelderfer who also provided secretarial assistance. We wish to record our thanks.

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APPENDIX III.

Resolution 10 (EC-XIII)

Development and use of meteorological satellites

The Executive Committee,

Noting :

(1) Resolution 28 (Cg-III) ;

(2) The report of the Panel of Experts on Artificial Satellites ; and

Considering :

(1) The very valuable information which has already been obtained from meteorological satellites ;

(2) The plans for further development and operational use of these satellites ; and

(3) The need for additional observations, in particular cloud observations, by conventional means for helping to interpret the information obtained from meteorological satellites ;

Decides :

(1) To encourage Members :

(*a*) To continue the development of meteorological satellites either individually or collectively by mutual agreement ;

(*b*) To collaborate with regional and international bodies concerned with space research with a view to ensuring that the meteorological applications of such research are included in their plans ;

(*c*) To collaborate in the making and study of additional documentation of cloud patterns observed by satellite by taking auxiliary observations and photographs of the same cloud system from ground stations, aircraft, rockets, etc., and by taking additional conventional meteorological observations and soundings in the same area ;

(2) To request the president of R.A. VI to study the possibility of establishing a main read-out station in north-west Europe ;

(3) To request the Presidents of all Regional Associations :

(*a*) To consider the question of establishing local read-out stations with a view to making the best possible use of information from meteorological satellites for special purposes such as following the development and movement of tropical cyclones ;

(*b*) To take any further steps which may be desirable for helping Members to derive the maximum from meteorological satellites ; and

Directs the Secretary-General to bring this resolution to the attention of all concerned and to send a copy of the second report of the Panel of Experts on Artificial Satellites to Members.

COMITÉS INTER-UNIONS

Comité Inter-Unions de Radiométéorologie

Nous attirons l'attention des membres du Comité Inter-Unions sur la communication suivante « W.M.O. - Investigation of the Atmospheric phenomena by means of artificial satellites » (voir p. 42).

Le Secrétaire Général de l'U.R.S.I. transmettra au Président et au Secrétaire du Comité tous commentaires et suggestions qui lui seront envoyés.

INTER-UNIONS COMMITTEES

Inter-Union Committee on Radio-Meteorology

We draw the attention of the members of the Inter-Union Committee to the paper « W.M.O. - Investigation of the atmospheric phenomena by means of artificial satellites » (see p. 43).

The Secretary General of U.R.S.I. shall inform the Chairman and the Secretary of the Committee on any comments and suggestions he will receive.

Inter-Union Commission on Solar and Terrestrial Relationships

Membership and Constitution

In 1958 the International Council of Scientific Unions dissolved its Joint Commission on Solar and Terrestrial Relationships; eventually in May 1960, it agreed to the formation of an Inter-Union Commission (I.A.U., I.U.G.G., and U.R.S.I.) under the auspices of the International Astronomical Union. A draft Constitution had already been approved, but it has taken some time to obtain nominations for initial membership from the constituent Unions.

Subject to the acceptance of the nominees the initial membership will be :

I.A.U.

C. W. Allen (U. K.)
J. F. Denisse (France)
R. Giovanelli (Australia)
E. R. Mustel (U. S. S. R.)

I.U.G.G.

J. Bartels (Germany)
B. Haurwitz (U. S. A.)
F. Link (Czechoslovakia)
M. Nicolet (Belgium)

U.R.S.I.

G. M. Allcock (New Zealand)
D. K. Bailey (U. S. A.)
R. Coutrez (Belgium)
A. H. Shapley (U. S. A.)

An informal meeting of the Inter-Union Commission will be held in Berkeley, California, immediately before the Eleventh General Assembly of the I.A.U. on Monday, 14 August 1961.

CONSTITUTION

Constitution

1. — The International Astronomical Union (I.A.U.), in co-operation with the International Union of Geodesy and Geophysics (I.U.G.G.) and the International Scientific Radio Union (U.R.S.I.), establishes an Inter-Union Commission on « Solar and Terrestrial Lelationships » (« Relations entre les Phénomènes Solaires et Terrestres ») as a successor to the former Joint Commission of the International Council of Scientific Unions.

2. — The Commission operates under the general rules governing Commissions of the I.A.U., and reports to the I.A.U., which undertakes to consult the other Unions in all appropriate matters.

Composition

3. — The Commission consists of twelve members, four of whom are appointed by each of the three co-operating Unions. At least one of the four members appointed by each Union is to be replaced, at intervals of not more than three years, by a new member who has not served as a member of the Commission during the previous six years.

4. — The Commission appoints its President, and other Officers, from among its members; Officers may not serve in the same capacity for more than six years.

5. — The Commission may appoint Corresponding Members, up to six in number, to serve as advisors.

Meetings and Publications

6. — The Commission will meet at least every three years.

7. — The Commission is encouraged to organize symposia, either in conjunction with its meetings or at other times.

8. — The Commission is authorized to arrange for the publication of the proceedings of meetings and symposia.

9. — In accord with Article 2, the arrangements for meetings, and summary reports of those meetings, are to be reported to the General Secretary of the I.A.U. Proposals for Symposia, and for publications, are to be submitted to the I.A.U. for approval in consultation with the other Unions.

Finance

10. — The I.A.U., through arrangements with the other Unions and other agencies, assumes responsability for financial support of the Commission and its activities.

11. — The Commission will submit requests for financial supports, estimates of costs of symposia and publications, and accounts of income and expenditure to the I.A.U. in accord with usual procedures.

Addendum

It is I.A.U. to give its Commissions freedom to organize themselves, and their activities, according to their own ideas as to how best their particular aims can be achieved. The above rules have consequently been restricted to certain fundamental requirements. The following more detailed notes are for the *guidance* of the Commission.

The General Secretary of the I.A.U. will provide assistance to the three Unions in ensuring that the independent nominations for membership from the three Unions are in accord with adequate scientific and regional representation. He will also assist the Commission in arranging for the initial election of President and Officers.

The Commission will naturally take similar considerations into account when appointing its Officers and Corresponding Members, and arranging meeting. It is, in general, undesirable that President and Secretary should be members appointed by the same Union, or nationals of the same country.

The Commission should keep the General Secretary of the I.A.U. fully informed of its activities. Although the I.A.U. is responsible for consultation with the other Unions, it will be both courteous and convenient for copies of all reports to be sent for information to the General Secretaries of the other Unions.

It will probably be convenient if the meetings of the Commission are held in close association, but not overlapping in time, with a General Assembly of the I.A.U., or of one of the other Unions.

Publication of the proceedings of meetings and symposia will require approval by the three Unions, in order to ensure that the publications conform to the high standards adopted by the Unions, that they receive adequate distribution, and that funds are available.

Limited funds will be available for secretarial expenses, and it is hoped that, as with other I.A.U. Commissions, these expenses will be kept to a minimum. The travelling expenses (in part or in total) of the President and Secretary in attending meetings will be reimbursed, and a grand will be available to assist the other members.

The I.A.U. will endeavour to obtain funds to meet all the expenses incurred by the Commission (travel expenses to meetings, symposia, publications) from sources outside its own proper income ; to the extent to which it is unable to do this, it will call on the other Unions for contributions.

LATIN-AMERICAN COUNCIL OF COSMIC RADIATION (CLARC)

Report on the Mexico Meeting

U.R.S.I. has been invited to appoint a representative to the meeting held by CLARC in Mexico, June 26-July 5.

Professor Alberto Vidal accepted to undertake this task and sent a preliminary report mentioning the following :

(*a*) The next meeting will take place in La Paz, probably in July 1963.

(*b*) Every five years or so the meetings will be held in Mexico City.

(*c*) The member countries should contribute to the general administrative costs ; it was suggested that $ 200 per year would be adequate. No definite action was taken.

(*d*) The cable address of the member countries is as follows : Nacnuclear, Mexico, Investigation, Argentina ; Brasfisicas, Brasil ; Pesquifisicas, Bolivia ; A.G.I. Lima, Peru.

(*e*) Dr. Manuel Sandoval Vallarta was reelected as President of Clarc. Dr. Ismael Escobar was designated as Secretary but in view of his illness Dr. Juan G. Roederer will continue acting as Secretary.

(*f*) CLARC will be a part of the Centro Latinoamericano de Fisica which is scheduled to begin functioning early next year in Brasil. At the request of the Centro Brasilero de Pesquisas Fisica that Institution would become the Centro, with Unesco's support and the approval on the Latin American countries.

(*g*) The next Geophysical Year will begin in April, 1964, and CLARC will participate. Professor Serge Korff of the New York University will supply all necessary information.

(*h*) Participants in these meetings were M. Sandoval Vallarta (Mexico), J. G. Roederer (Argentina), G. Schwachhleim (Brasil), N. Nerurkar (Bolivia), S. Korff (U. S. A.), H. Elliot (England), A. Vidal (Peru) and a Unesco representative.

A more complete report including technical results of the meeting will be published in a forthcoming issue of the Bulletin.

ANNÉE GÉOPHYSIQUE INTERNATIONALE

Données Ionosphériques

English text, p. 76

Les volumes XIII et XIV des *Annals of the International Geophysical Year* (Pergamon Press) viennent de paraître.

Ce sont les deux premiers volumes d'une série de cinq consacrée à la publication des tables des valeurs moyennes mensuelles des caractéristiques ionosphériques pour la période s'étendant de juillet 1957 à janvier 1959 inclus.

Dans la préface, le Prof. W. J. G. Beynon, Rapporteur de l'A.G.I. pour l'Ionosphère, expose comment ont été recueillies les données publiées : « Dès le début de l'Année Géophysique Internationale, la publication définitive des données ionosphériques a été étudiée. En septembre 1954 le Comité U.R.S.I.-A.G.I. a procédé à une étude préalable de cette question et a recommandé que les organismes nationaux en relation avec l'A.G.I. fournissent leurs résultats aussi rapidement que possible. L'année suivante le Comité établit un sous-comité (connu sous le sigle W.W.S.C.) pour examiner les moyens de normaliser les dépouillements des enregistrements $h'(f)$ et la publication des caractéristiques ionosphériques pendant l'A.G.I. En 1956, ce sous-comité recommanda aux organismes nationaux qu'ils s'efforcent de publier le maximum de données sous forme de fascicules et qu'une priorité soit réservée aux tableaux récapitulatifs des médianes mensuelles pour chaque heure et pour chacun des douze paramètres suivants : f_oF2, h'F2, (M3000)F2, f_oF1, h'F, (M3000)F1, f_oE, h'E, $f$min, f_oEs, f_bEs, h'Es.

Le rassemblement des données à publier dans les Annales a été effectué au Centre Mondial C1 (Slough) en collaboration avec les autres centres mondiaux (Boulder, Moscou, Tokyo).

Le premier volume des données ionosphériques de l'A.G.I. a été publié grâce à l'excellente collaboration de nombreux chercheurs ; le C.S.A.G.I. et le Comité International de Géophysique les remercient et tiennent à exprimer leur gratitude au Dr. C. M. Minnis qui a dirigé avec une exceptionnelle compétence la préparation des manuscrits pour l'impression ».

Pour la publication, les stations ont été classées par ordre alphabétique et les tableaux relatifs à chacune des stations sont précédés des renseignements essentiels la concernant, extrait du Manuel des Stations Ionosphériques publié par l'U.R.S.I. (Ce Manuel est en vente au Secrétariat Général de l'U.R.S.I. Il contient également les valeurs horaires de cos χ et d'autres renseignements utiles).

Le Volume XIII des Annals contient les données des 31 stations ci-après :

Ahmedabad	Calcutta	Ft Monmouth.
Akita	Capetown	Freiburg
Alma Ata	Chimbote	Fletcher Ice Is.
Anchorage	Chita	Gorky
Arctica I	Churchill	Grand Bahama
Arctica II	De Bilt	Grahamstown
Ashkabad	Delhi	Gray
Baker Lake	Dixon Island	Halley Bay
Bombay	Elisabethville	Huancayo
Budapest	Ellsworth	
Bunia	Fairbanks	

Le Volume XIV contient les données fournies par les 27 stations de :

Inverness	Little America	Murmansk
Irkutsk	Longyearbyen	Narsarssuak
Johannesburg	Lulea	Numijarvi
Juliusruh (Rügen)	Lycksele	Okinawa
Kiruna	Macau	Oslo
Kodaikanal	Madras	Panama Canal
Kokubunji	Maui	Point Barrow
Leningrad	Miedzeszyn	Port Lockroy
Léopoldville	Moscow	Port Stanley

INTERNATIONAL GEOPHYSICAL YEAR

Ionospheric Data

Volume XIII and XIV of the *Annals of the International Geophysical Year* are out press (Pergamon Press).

They are the two first volumes of a series of five of I.G.Y. data containing tables of mounthly median values of ionospheric characteristics for the period July 1957-January 1959 inclusive.

In the preface, Prof. W. J. G. Beynon, I.G.Y. Reporter for Ionosphere, explains how the published data have been collected :

« In the earliest planning stages of the International Geophysical Year consideration was given to the ultimate publication of I.G.Y. ionospheric data. Thus in September 1954 the U.R.S.I.-A.G.I. Committee gave some preliminary consideration to the question and adopted a resolution recommending that « National organizations associated with the I.G.Y. make the results of their studies available as quickly as possible ». The following year the same Committee established a Sub-Committee (later known as the « World-Wide Sounding Committee ») « to consider procedures for the uniform scaling of $h'(f)$ records and the publication of ionospheric characteristics during the I.G.Y. ». In 1956 this U.R.S.I.-A.G.I. Sub-Committee recommended that national organizations ensure that as much I.G.Y. data as possible should be published in booklet form and that first priority should be given to summary tables of monthly medians for each hour for the following twelve parameters : f_oF2, h'F2, (3000)F2, f_oF1, h'F, (M3000) F1, f_oE, h'E, $f$min, f_oEs, f_bEs, h'Es.

Arrangements for the final publication in the I.G.Y. Annals of selected ionospheric parameters were discussed by a C.S.A.G.I. Working Group meeting at Uccle on 1-4 April 1957, and it was agreed, that as far as vertical sounding data are concerned, this should also consist in the monthly median hourly values of the above twelve quantities for all I.G.Y. stations.

The assembly of the data for publication in the Annals has been

carried out at W.D.C.-C1 (Slough) with the full collaboration of the other World Data Centres (Boulder, Moscow, and Tokyo).

The first volume of I.G.Y. ionospheric data is the result of an excellent co-operative effort by many workers and the thanks of C.S.A.G.I. and of its successor, the Comité International de Géophysique (C.I.G.), are due to all those concerned. An especial work of appreciation is accorded to Dr. C. M. Minnis of the Radio Research Station, Slough, for his invaluable supervision of the final preparation of the material for the press ».

For the publication the stations have been arranged in alphabetical order and the tables for each station are preceded by some of the more important information relating to the station. This information has been taken out from the Ionospheric Station Manual (U.R.S.I. 1958, in sale at the General Secretariat of U.R.S.I.) which also contains hourly values of $\cos\chi$ and many other useful data.

Volume XIII of the Annals contains data from the following 31 stations :

Ahmedabad	Calcutta	Ft. Monmounth.
Akita	Capetown	Freiburg
Alma Ata	Chimbote	Fletcher Ice Is.
Anchorage	Chita	Gorky
Arctica I	Churchill	Grand Bahama
Arctica II	De Bilt	Grahamstown
Ashkabad	Delhi	Graz
Baker Lake	Dixon Island	Halley Bay
Bombay	Elisabethville	Huancayo
Budapest	Ellsworth	
Bunia	Fairbanks	

Volume XIV contains data provided by 27 stations, namely :

Inverness	Little America	Murmansk
Irkuts	Longyearbyen	Narsarssuak
Johannesburg	Lulea	Numijarvi
Juliusruh/Rügen	Lycksele	Okinawa
Kiruna	Macau	Oslo
Kodaikanal	Madras	Panama Canal
Kokubunji	Maui	Point Barrow
Leningrad	Miedzeszyn	Port Lockroy
Leopoldville	Moscow	Port Stanley

Bibliography

The following parts of the Annals of the I.G.Y. have been issued :

Vol. X. — The fifth meeting and the termination of C.S.A.G.I., M. Nicolet and F.W. G. Baker.

Vol. XII. — Parts 1 and 2 — First results of I.G.Y. rocket and satellite research, H. E. Newell Jr. and L. N. Cormier.

UNESCO

Tendances actuelles de la recherche scientifique

par le Professeur Pierre Angers

English text, p. 80

En 1960, l'Assemblée générale des Nations Unies décida qu'une étude devait être faite sur les tendances actuelles de la recherche scientifique, sur la diffusion des connaissances scientifiques et leur application à des fins pacifiques. Le professeur Pierre Auger, éminent physicien et ancien directeur du Département des Sciences exactes et naturelles de l'Unesco, fut chargé par le Secrétaire général des Nations Unies et le Directeur général de l'Unesco de réunir les informations et de rédiger le rapport. 29 organisations intergouvernementales, 66 organisations internationales non-gouvernementales et les organisations nationales de recherche de 42 pays ont été consultées. De plus, les experts scientifiques de tous les pays ont été consultés à titre individuel.

Le professeur Auger se heurtait d'emblée à de nombreuses difficultés, d'abord celles qui résultaient du caractère essentiellement transitoire des renseignements à donner. Si le contenu de la science change assez vite, le type de recherches en cours risque de changer encore plus vite, celles-ci étant soumises à toutes sortes d'influences, matérielles ou intellectuelles, expérimentales ou théoriques. Ensuite, il est plus difficile de se procurer ce type de renseignements, qui ne sont pas en général rendus publics par les chercheurs et les laboratoires, ceux-ci préférant ne publier que les résultats achevés. Il était tout aussi indispensable d'analyser les facteurs sous l'influence desquels se sont produits récemment et une multiplication des disciplines particulières et un effort de synthèse interdisciplinaire ; on ne pouvait oublier d'autre part que

toute description de la recherche scientifique qui séparerait d'une façon absolue la science pure de la science appliquée fausserait le jeu naturel entre la connaissance et l'action. Enfin, le plan même adopté dans le corps du rapport, s'inspirant en gros de la classification d'Auguste Comte, n'en rassemble pas moins des sujets pris en divers points de cette classification, si par exemple ce groupement correspond à une grande préoccupation de l'humanité.

Les recommandations formulées en conclusion de cet ouvrage portent aussi bien sur la politique scientifique des Etats, que sur les champs d'activité à élargir. Pour reprendre une expression du professeur Auger, « quand un navire donne sa position, il indique sa latitude et sa longitude, puis il ajoute : faisant route au nord, vitesse 12 nœuds ».

Le plan général de l'enquête est basé sur une division fonctionnelle de la recherche scientifique, plutôt que sur une classification des sciences de caractère académique. Une telle classification, établie par le Comité consultatif spécial, suit les besoins de l'homme et correspond par le fait même aux structures institutionnelles de la recherche scientifique les plus fréquemment adoptées au niveau national et international. Elle offre donc l'avantage d'une répartition aisée des matières traitées entre les diverses institutions de recherche orientée, dans lesquelles l'applicabilité des résultats de la recherche conditionne pour une large part les efforts consentis. Tel est le cas par exemple de la recherche médicale, de la recherche agronomique, de la recherche sur l'énergie nucléaire.

Le rapport se divise en trois parties : La première : Les tendances principales de la recherche scientifique, a six chapitres principaux : I. Les sciences fondamentales ; II. Sciences de la terre et des espaces extra-terrestres ; III. Sciences médicales ; IV. Sciences de l'alimentation et de l'agriculture ; V. Combustibles et énergie ; VI. Recherche industrielle. La deuxième partie traite des tendances générales dans l'organisation de la recherche scientifique et la diffusion des résultats, et la troisième des recommandations générales et spéciales concernant la recherche scientifique, la diffusion des connaissances scientifiques et leur mise en application à des fins pacifiques. Les trois parties sont précédées d'une longue introduction du professeur Auger.

Le livre n'est pas seulement le premier en son genre, il sera probablement aussi un des ouvrages scientifiques de base les plus

importants des dix années à venir. Cet ouvrage est d'un intérêt exceptionnel pour les institutions de recherche scientifique, pour les universités, les fonctionnaires chargés de questions scientifiques, les professeurs et pour l'industrie, ainsi que pour tous ceux qui s'intéressent à l'histoire et au développement des sciences.

Cet ouvrage est vendu au prix de N. F. français 17,50 *par les Agents des Publications de l'Unesco existant dans divers pays.*

Current trends in scientific research

by Professor Pierre Angers

In 1960, the General Assembly of the United Nations decided that a survey should be made on current trends of enquiry in the fields of the natural sciences and the dissemination and application for peaceful ends of such scientific knowledge. The Secretary-General of the United Nations and the Director-General of Unesco jointly appointed Professor Pierre Auger, a leading physicist, formerly of the Unesco Natural Science Department, to collect data and draft the report. Twenty-nine intergovernmental organisations, sixty-six international non-governmental organisations and scientific unions, and the national research organisations of forty-two countries were consulted. The list of experts consulted in their individual capacity contains the names of leading scientists in all countries of the world.

Professor Auger faced a number of difficulties. These in the first place resulted from the essentially transitory nature of the required information. If the content of scientific knowledge is undergoing fairly rapid changes, the types of current enquiry are likely to change even more swiftly, since they are subject to influences of all kinds, whether material or intellectual, empirical or theoretical. Furthermore, it is difficult to gain access to this type of information, which as a general rule is not made known by scientists and laboratories, who prefer to publish only the results obtained. Then the problem arose of the method to be adopted. It was deemed wise to consider not only the factors responsible for the multiplication of specialized disciplines but also the opposite movement towards synthesis. Nor could one forget that any

description of scientific research which draw a hard and fast line between pure and applied science would distort the natural interplay between knowledge and action. Eventually, the actual plan adopted in the body of the report broadly follows the classification of Auguste Comte, but groups together subjects from various parts of this classification where such a grouping, for instance, corresponds to a major concern of mankind.

The proposed measures with which the report concludes relate as much to the scientific policy of governments as to the fields which deserve broader action or better coordination. To quote from Professor Auger : « When a ship reports its position, it gives first its latitude and longitude, and then adds : steaming norths at 12 knots ».

The general outline of the survey is based on a functional division of scientific research rather than on a purely academic classification of sciences. A classification of this type, as prepared by the Special Advisory Committee, reflects man's needs and accordingly corresponds to the institutional structures usually adopted for scientific research at the national and international level. The topics covered can thus easily be divided among the different institutions engaged in applied research, whose work depends to a great extent on the use to be made of the research results. This applies, for example, to medical and agricultural research, research on nuclear energy, etc.

The book is divided into three parts : Part One, « Trends of scientific research », has six main chapters : I. Fundamental sciences ; II. The earth and space sciences ; III. Medical sciences ; IV. Food and agricultural sciences ; V. Fuel and power research ; VI. Industrial research. Part two deals with the main trends affecting the organisation of scientific research and the dissemination of results, and Part Three, general and special recommendations concerning scientific research, the dissemination of scientific knowledge and the application of such knowledge to physical needs. These three parts are preceded by a long introduction by Professor Auger.

This book is not only the first of its kind, but is also likely to be one of the most important basic scientific works of the coming decade. It will be of exceptional interest to science research

institutions, universities, government science officers, science teachers, and also to state — and privately — owned industry and to all who are interested in the history and development of science.

This work is available at the price of $ 6.75 *or* 33/ *by the Libraries selling Unesco publications.*

Dates	Endroit — Location	Sujet — Subject	Organisateurs — Organizers
1961			
August 6-18	Arosa, Suisse	Symposium sur l'ozone atmosphérique et la circulation	O.M.M., campagne Rigot, 1, avenue de la Paix, Genève.
August 14-19	Vienna	International symposia of the Radiation Association of Meteorology and Atmospheric Physics and W.M.D.	Idem.
August 15-24	Berkeley, California	11th General Assembly of the International Astronomical Union	Mr. D. H. Saddler, General Secretary of I.A.U., Royal Greenwich Observatory, Herstmonceaux Castle, Sussex, U. K.
August 24-26	Sacramento Peak, California.	I.A.O. Symposium on the Solar Coronar.	Idem.
August 28-September 1	Munich	5me Conférence Internationale sur les phénomènes d'ionisation dans les gaz.	Secretariat, Oskar von Miller Ring 18, Munich 1, P. O. 463, Allemagne.
August 30-September 6	Norwick, Norfolk	Annual Meeting of the British Association for the Advancement of Science.	Secretary of the Association, 18 Adam Street Adelphi, London W.C.2.
September 4-15	Kyoto, Japan	Symposium on the Earth Storms and Cosmic Ray.	Prof. T. Nagata, Geophysical Institute, Tokyo University, Tokyo.
September 11-15	Namur, Belgique	3me Congrès International de Cybernétique.	Association Internationale de Cybernétique.

Dates	Endroit — Location	Sujet — Subject	Organisateur — Organizer
September 15-17	London	I.C.S.U.-Meeting of the Bureau	I.C.S.U. Administrative Secretariat, Paleis Nordeinde, The Hague, Netherlands.
September 19-23	Idem	I.C.S.U. Meeting of the Executive Board	Idem.
September 25-28	Idem	I.C.S.U. General Assembly	Idem.
September 18-25	Paris	U.R.S.I. Symposium on Space Communication Research.	Dr. J. R. Pierce, Bell Telephone Laboratories, Murray Hill, New Jersey, U. S. A., and Mr. G. M. Brown, University College of Wales, Aberystwyth, U. K.
September 21-22	Bangor, N. Wales	Conference on radio-frequency in solids.	The Physical Society, 1, Lowther Gardens, Prince Consort Road, London, S. W. 7.
December 11-16	Nice, France (?)	U.R.S.I. Symposium on Ionospheric Results during the I.G.Y.	U.R.S.I. General Secretariat, 7, Place Emile Danco, Bruxelle 18, and Mr. G. M. Brown, University College of Wales, Aberystwyth, U. K.
1962 June 25-30	Copenhagen	U.R.S.I. Symposium on Electromagnetic Theory and Antennas.	Secretary of the Symposium, Øster Voldgate 10 G, Copenhagen K, Denmark.

BIBLIOGRAPHIE

Renseignements pour l'achat de publications
de la Commission Electrotechnique Internationale

English text, p. 93

1) Les publications de la C.E.I. paraissent sous la forme de brochures bilingues, dont les deux textes sont imprimés sur les pages en regard. Elles sont éditées dans les deux versions suivantes :

(i) Français/Anglais,
(ii) Russe/Anglais.

Il est à noter que toutes les publications ne sont pas actuellement disponibles dans la version Russe/Anglais ; celles dont la version Russe/Anglais est en préparation sont indiquées par un double astérisque (**).

Pour la commande de publications dont il existe une version Français/Anglais et une version Russe/Anglais, il y a lieu de préciser quelle est la version désirée.

Si cela n'est pas précisé lors de la commande, on livrera l'une ou l'autre version suivant leur disponibilité.

2) Il y a lieu d'indiquer avec précision le numéro de la publication commandée, notamment si la commande porte sur des publications éditées en plusieurs parties (par exemple 34, 50, 56, 68, 70, 98, 117, 122, etc.). Si la commande d'une publication éditée en plusieurs parties mentionne uniquement le numéro de la série complète, toutes les parties de cette publication seront fournies (par exemple si la commande indique simplement « Publication 34 », les trois parties, à savoir 34-1, 34-2 et 34-3 seront expédiées).

En cas de doute possible, prière de mentionner le titre intégral de la publication ainsi que son numéro.

N. B. — La présente liste donne les titres d'un certain nombre de publications provisoirement épuisées et ne pouvant donc être fournies pour le moment.

3) Les publications de la C.E.I. sont en vente au Bureau Central de la C.E.I. (Service de vente des publications) 1, rue de Varembé, Genève, Suisse, ainsi qu'aux Secrétariats des différents Comités nationaux de la C.E.I., dont les adresses seront envoyées sur demande.

4) Les prix indiqués dans la présente liste ne sont valables que pour les commandes passées au Bureau Central de la C.E.I. Les frais de port sont facturés pour toute commande.

Liste numérique des publications de la C.E.I.

Extraits

Explication des signes :

* Les publications marquées d'un seul astérisque sont des publications en révision pour lesquelles il est prévu que la nouvelle édition paraîtra prochainement.

** Les publications marquées d'un double astérisque sont celles dont la version Russe/Anglais est en préparation et sera disponible sous peu.

N. B. — La présente liste mentionne toutes les publications de la C.E.I. qui sont d'un intérêt actuel, y compris celles qui sont épuisées pour le moment.

27 (1953)* *Symboles littéraux internationaux utilisés en électricité* (*Symboles de grandeurs, alphabets et caractères*), 15 p., 3 fr. s., français-anglais.

Contient une liste de symboles littéraux utilisés en électricité et précise comment ceux-ci peuvent être employés et combinés. Spécifie les alphabets et les caractères à utiliser.

50 : — *Vocabulaire Electrotechnique International.*

Glossaire de termes utilisés en électrotechnique suivis de leurs définitions en anglais et en français. Les termes équivalents seuls sont donnés en allemand, en espagnol, en italien, en néerlandais ([1]), en polonais et en suédois. Contient un index séparé pour chacune des huit langues. Le vocabulaire est publié sous forme de fascicules séparés, chaque fascicule traitant d'un domaine particulier.

50(05) (1954) *Définitions fondamentales,* 102 p., 8 fr. s.
50(07) (1956) *Electronique,* 157 p., 12 fr. s.
50(08) (1960) *Electroacoustique,* 67 p., 10 fr. s.
50(20) (1958) *Appareils de mesure scientifiques et industriels,* 88 p., 9 fr. s.

65 (1952)* *Règles de sécurité pour les récepteurs radiophoniques reliés à un réseau de distribution d'énergie,* 49 p., 5 fr. s., français-anglais. Modification 1 (1958), 11 p., 2 fr. s., français-anglais, russe-anglais.

Cette spécification a été établie en plein accord par la C.E.I. et la C.E.E. (Commission Internationale de Réglementation en vue de l'Approbation de l'Equipement Electrique) et remplace la Publication de la C.E.E. traitant du même sujet éditée en juin 1948. Elle est identique à la Publication n° 1 de la C.E.E.

([1]) Sauf pour les publications 50(05) 50(10) et 50(70).

Concerne les récepteurs radiophoniques à usage domestique ou à usage général analogue utilisés dans des locaux secs et destinés à être reliés au réseau de distribution soit directement, soit par l'intermédiaire d'appareils auxiliaires. Traite exclusivement de la *sécurité* des récepteurs radiophoniques et des appareils auxiliaires.

65-1 (1955) *Annexe I. Spécifications particulières pour amplificateurs reliés à un réseau de distribution d'énergie*, 31 p., 4 fr. s., français-anglais.

Etend le domaine d'application de la Publication 65 aux amplificateurs.

65-2 (1955) *Annexe II. Spécifications particulières pour haut-parleurs indépendants.* 23 p., 4 frs s., français-anglais.

Etend le domaine d'application de la Publication 65 aux haut-parleurs indépendants,

65-3 (1960) *Annexe III. Spécifications particulières pour récepteurs de télévision reliés à un réseau de distribution d'énergie.* 24 p., 4 fr. s., français-anglais**

Etend le domaine d'application de la Publication 65 aux récepteurs de télévision reliés à un réseau de distribution d'énergie.

67 (1954) *Dimensions des tubes électroniques.* 1re édition 1954 comprenant les 1er et 2e suppléments. 97 p., 15 fr. s., français-anglais.

Indique les dimensions avec les tolérances nécessaires des embases, des douilles et des culots des tubes électroniques et les calibres et procédés de calibrage correspondants, afin de permettre l'interchangeabilité. Cette publication est composée de feuillets détachables. La C.E.I. publie de temps en temps de nouvelles feuilles et des feuilles révisées.

1er supplément (1955) 2 fr. s. français-anglais,
2e supplément (1957) 8 fr. s. français-anglais,
3e supplément (1958) 6 fr. s. français-anglais, russe-anglais
4e supplément (1960) 6 fr. s. français-anglais**

68 : — *Essais fondamentaux climatiques et de robustesse mécanique recommandés pour les pièces détachées pour matériel électronique.*

Décrit les essais généraux normalisés, climatiques et mécaniques des pièces détachées pour les matériels de télécommunications et pour les dispositifs électroniques basés sur des techniques analogues, en vue de déterminer leur aptitude à fonctionner dans des conditions d'emploi variées et à être transportées et stockées.

Cette publication est éditée en deux parties :

68-1 (1960) 1re *partie : Généralités.*

Contient des indications d'ordre général concernant l'exécution des essais. 28 p., 8 fr. s., français-anglais**

68-2 (1960) 2e *partie : Essais.*

Décrit les différents essais en détail. Cette partie est publiée sous forme de fascicules détachables ; des suppléments paraîtront de temps à autre. 64 p., 18 fr. s., français-anglais**

69 (1954)* *Méthodes recommandées pour les mesures sur les récepteurs radiophoniques pour émissions de radiodiffusion à modulation d'amplitude.* 91 p., 10 fr. s., français-anglais.

Recommande les conditions et les méthodes de mesure pour l'estimation et la comparaison des performances des récepteurs radiophoniques pour émissions sonores de radiodiffusion à modulation d'amplitude établis pour la réception sur haut-parleurs dans la gamme de fréquences comprise entre 150 kHz et 26,1 MHz, que ces récepteurs soient alimentés par le réseau ou par piles.

Constitue simplement un catalogue de mesures sélectionnées pour évaluer les propriétés essentielles des récepteurs d'un type déterminé et ne stipule aucun critère de qualité.

70 : — *Spécification pour condensateurs de réseau.*

Applicable, pour des températures et des altitudes stipulées, aux condensateurs destinés à être raccordés à un réseau alternatif basse ou haute tension, de fréquence inférieure ou égale à 100 Hz et servant à l'amélioration du facteur de puissance, au couplage avec d'autres systèmes électriques, à la protection contre les surtensions et aux autres applications en courant alternatif à basse fréquence.

Prescrit des règles de sécurité, des règles relatives au fonctionnement, aux essais de type et aux essais individuels, les caractéristiques nominales et des directives pour l'installation et l'utilisation.

Cette publication est éditée en trois parties.

70-1 (1954) 1re *partie.* 17 p., 3 fr. s. français-anglais.

Contient les chapitres traitant des prescriptions générales, des règles de sécurité, des règles de qualité et des essais.

70-2 (1955) 2e *partie.* 17 p., 3,75 fr. s., français-anglais.

Contient un chapitre relatif aux caractéristiques nominales, donne des directives pour l'installation et l'utilisation.

70-3 (1957) 3e *partie*. 11 p., 3 fr. s. français-anglais.

Etend le domaine d'application des première et deuxième parties aux condensateurs pour climats tropicaux.

91 (1958) *Méthodes recommandées pour les mesures sur les récepteurs radiophoniques pour émissions de radiodiffusion à modulation de fréquence*. 90 p., 15 fr. s., français-anglais, russe-anglais.

Recommande les conditions et les méthodes de mesure pour l'estimation et la comparaison du fonctionnement des récepteurs radiophoniques pour émissions sonores de radiodiffusion à modulation de fréquence établis pour la réception sur haut-parleurs dans la gamme de fréquences comprise entre 87,5 MHz et 108 MHz, que ces récepteurs soient alimentés par le réseau ou par batteries.

Constitue simplement un catalogue de mesures sélectionnées pour évaluer les propriétés essentielles des récepteurs d'un type donné et ne stipule aucun critère de qualité.

96 : — *Recommandations relatives aux câbles pour fréquences radioélectriques.*

Etablit des prescriptions pour les câbles coaxiaux flexibles ou semi-flexibles ainsi que pour les conducteurs du type jumelé (ou en paires) pour fréquences radioélectriques destinés à être utilisés dans les équipements de radio-communication et dans les systèmes électroniques basés sur des techniques analogues. Le diélectrique de ces câbles peut être du type massif, aéré ou semi-aéré et réalisé avec un diélectrique constitué par une résine thermo-plastique polymérisée à faibles pertes, un mélange thermodurcissable ou une matière minérale.

Etablit des conditions uniformes d'appréciation des propriétés électriques, climatiques et mécaniques des câbles utilisés aux fréquences radioélectriques et décrit des méthodes d'essai.

Pour les valeurs des impédances caractéristiques normalisées, voir la Publication 78.

Cette publication sera éditée en plusieurs fascicules.

96-1 (1958) *Première partie : Prescriptions et méthodes de mesure générales*. 32 p., 7,50 fr. s., français-anglais, russe-anglais.

Prescrit des règles générales, des essais électriques, climatiques et de robustesse mécanique et spécifie des méthodes de marquage.

100 (1958)* *Méthodes recommandées pour la mesure des capacités interélectrodes des tubes électroniques*. 52 p., 10 fr. s., français-anglais, russe-anglais.

Concerne la mesure des capacités interélectrodes des tubes appartenant aux classes suivantes : tubes de réception, tubes à rayons cathodiques, tubes à gaz, tubes photoélectriques et

photomultiplicateurs, tubes à vide de puissance. Comprend des tableaux de branchement des éléments et des électrodes de tubes pour les mesures de capacité interélectrodes et des descriptions des méthodes de mesure. Définit également les conditions à satisfaire pour la mesure des capacités interélectrodes pour les supports, les blindages et les connecteurs de coiffe normalisés.

106 (1959) *Méthodes recommandées pour les mesures de rayonnement sur les récepteurs radiophoniques pour émissions de radiodiffusion à modulation d'amplitude et à modulation de fréquence et sur les récepteurs de télévision.* 34 p., 9 fr. s., français-anglais**

Contient la description de méthodes d'essais normalisées pour déterminer le rayonnement des récepteurs de radiodiffusion et de télévision, afin de permettre la comparaison des résultats des mesures de rayonnement obtenues par différents opérateurs. Les valeurs des performances acceptables ne sont pas spécifiées. Elle est divisée en deux sections :

— Mesures de rayonnement aux fréquences inférieures à 30 MHz.
— Mesures de rayonnement aux fréquences comprises entre 30 et 300 MHz.

107 (1960) *Méthodes recommandées pour les mesures sur les récepteurs de télévision.* 151 p., 25 fr. s. français-anglais**

Décrit des méthodes de mesure des propriétés électriques, acoustiques et optiques des récepteurs de télévision établis pour la réception d'images en noir et blanc de définition égale à 405, 525, 625 et 819, et de modulation positive ou négative avec la réception du son correspondante, à modulation d'amplitude ou de fréquence. Elle a pour objet de constituer un catalogue de mesures sélectionnées recommandées pour évaluer les propriétés essentielles d'un récepteur d'un type donné et ne stipule aucun critère de qualité.

108 (1959) *Recommandations pour condensateurs à diélectrique en céramique type I.* 51 p., 10 fr. s., français-anglais**

Applicable aux condensateurs fixes à diélectrique en céramique d'un type convenant spécialement à l'utilisation dans les circuits résonnants ou pour d'autres applications qui exigent de faibles pertes et une grande stabilité de capacité, mais à l'exclusion des condensateurs pour des courants à fréquences radioélectriques supérieurs à 1 A ou de puissance réactive supérieure à 200 var, destinés au matériel de télécommunication et aux dispositifs électroniques basés sur des techniques analogues.

Etablit des règles uniformes pour l'appréciation des propriétés mécaniques, électriques et climatiques des condensateurs, décrit les méthodes d'essais et spécifie un code des couleurs pour

l'indication des valeurs de capacité et de tolérances. Contient des recommandations pour leur classification en catégories d'après leur aptitude à supporter les conditions spécifiées dans la Publication 68.

110 (1959) *Recommandations concernant les condensateurs de puissance soumis à des fréquences comprises entre* 100 *et* 20.000 *Hz.* 23 p., 6 fr. s., français-anglais**

Applicable aux condensateurs de fréquences comprises entre 100 et 20.000 Hz et les ensembles de condensateurs du type précité formant une installation complète avec leurs accessoires destinés à être raccordés à un réseau alternatif autre que les réseaux de distribution et servant à améliorer le facteur de puissance et à modifier les caractéristiques d'un circuit, par exemple la fréquence pour laquelle il est accordé. Prescrit les conditions d'emploi de ces condensateurs, des règles de sécurité, des règles pour les essais et les caractéristiques nominales. Contient également des directives pour l'installation et l'utilisation.

124 (1960) *Recommandations concernant les impédances nominales et les dimensions des haut-parleurs.* 8 p., 3 fr. s., français-anglais**

Concerne les haut-parleurs à rayonnement direct, à un seul conducteur mobile. Prescrit les valeurs des impédances nominales du conducteur mobile (à l'exclusion du transformateur) et les dimensions et la disposition des trous de fixation.

Supplément à la liste des publications de la C.E.I., 1960

Comité International Spécial des Perturbations Radioélectriques (C.I.S.P.R.).

C.I.S.P.R. 1 (première édition) : Spécification de l'appareillage de mesure C.I.S.P.R. pour les fréquences comprises entre 0,15 et 30 MHz, prix : 12 fr. s.

C.I.S.P.R. 2 (première édition) : Spécification de l'appareillage de mesure C.I.S.P.R. pour les fréquences comprises entre 25 et 300 MHz, prix : 12 fr. s.

Les publications ci-après sont en cours d'impression. La date probable de parution figure entre parenthèses après le titre de la publication.

64 (troisième édition) : Lampes à filament de tungstène pour l'éclairage général (mai 1961).

96-1 (deuxième édition) : Câbles pour fréquences radioélectriques. Première partie : Prescriptions et méthodes de mesures générales (juillet 1961).

96-2 (première édition) : Câbles pour fréquences radioélectriques. Deuxième partie : spécifications particulières de câbles (juillet 1961).

100 (deuxième édition) : Méthode recommandée pour la mesure des capacités interélectrodes des tubes électroniques (juillet 1961).

122-1 (première édition) : Quartz pour oscillateurs. Première section : spécification. Deuxième section : méthodes de mesure (juin 1961).

122-3 (première édition) : Quartz pour oscillateurs. Quatrième section : dimensions des boîtiers (juin 1961).

125 (première édition) : Classification générale des matériaux en oxydes ferromagnétiques et définition des termes (juin 1961).

135 (première édition) : Système de numérotation pour les tubes électroniques (juin 1961).

Commission Electrotechnique Internationale

Publication 78. *Deuxième édition.* — Impédances caractéristiques et dimension des câbles coaxiaux pour fréquences radioélectriques.

Cette publication contient des recommandations relatives à ces paramètres, mais sans entrer dans des détails de construction ni stipuler des méthodes d'essai. La deuxième édition, qui vient de paraître, diffère de la première en ce que la publication n'est plus limitée aux câbles à diélectrique en polyéthylène massif, comme c'était le cas précédemment.

Publication 81. *Deuxième édition.* — Lampes tubulaires à fluorescence pour l'éclairage général.

Publication 126. *Première édition.* — Coupleur de référence de la C.E.I. pour la mesure des appareils de correction auditive utilisant des écouteurs couplés à l'oreille par des embouts.

Publication 133. *Première édition.* — Dimensions des circuits magnétiques en pots en oxydes ferromagnétiques.

Ces publications sont en vente au Bureau Central de la C.E.I., au prix de 3 fr. s. l'exemplaire, plus frais de port pour les Publications 78 et 133, 4 fr. s. l'exemplaire pour la publication 126 et 15 fr. s. l'exemplaire, plus frais de port pour la publication 81.

Union Internationale des Télécommunications

Nomenclature des stations côtières, 1re édition 1960.

Nomenclature des stations de navire, 1re édition 1960.

Ces nomenclatures qui, d'après les dispositions du Règlement des radiocommunications doivent être en possession des stations à bord des navires obligatoirement pourvus d'une station radiotélégraphique, peuvent aussi être d'une grande utilité pour d'autres stations de navire ainsi que pour les armateurs, les entreprises de sauvetage, de transport, etc.

La nomenclature des stations côtières contient : La préface. L'index alphabétique des stations côtières. Les états signalétiques des stations côtières du monde entier, rangées à l'ordre alphabétique du nom du pays. Les renseignements portent sur le nom de la station, l'indicatif d'appel, les fréquences utilisées, les classes et puissances d'émission, la nature du service effectué, les heures d'ouverture, les taxes, la position géographique, l'exploitant, et tout autre détail utile à l'exploitation. A la fin de ce volume se trouvent des renseignements sur les taxes télégraphiques intérieures et limitrophes perçues pour l'acheminement de la correspondance à destination du pays où se trouve la station côtière ou des pays limitrophes.

Cette Nomenclature sera tenue à jour au moyen de suppléments récapitulatifs semestriels.

La nomenclature des stations de navire contient : La préface. Les états signalétiques des stations de navire, rangées à l'ordre alphabétique du nom de la station, sans considération de nationalité. Les renseignements portent sur le nom du navire, l'indicatif d'appel, le pays dont relève la station, les fréquences utilisées, les puissances et classes d'émission, la nature du service, les heures d'ouverture, les taxes perçues pour l'échange de la correspondance, le liquidateur des comptes et, suivant le cas, le propriétaire du navire, le nombre d'embarcations de sauvetage équipées d'appareils radioélectriques, etc. A la fin de ce volume se trouvent les observations relatives aux stations de navire.

Les titres des couvertures et les textes explicatifs sont rédigés dans les langues française, anglaise et espagnole.

Le prix de vente de chacune de ces nomenclatures, frais de port par poste ordinaire et emballage compris, a été fixé comme suit :

Nomenclature des stations côtières, y compris les suppléments semestriels (530 pages) : 10 fr. s.

Nomenclature des stations de navire (524 pages) : 6,15 fr. s.

BIBLIOGRAPHY

How to buy publications of the International Electrotechnical Commission

1) I.E.C. Publications are issued in the form of two-language booklets, the two texts being printed on facing pages. Two versions are available, viz.

(i) French/English,

(ii) Russian/English.

It should be noted that not all Publications are as yet available in the Russian/English version ; those for which this version is in preparation are marked by a double asterisk (**).

When ordering a publication for which both a French/English and a Russian/English version is available, the version required should be clearly stated in the order.

Unless the order clearly specifies which of the above versions is required, either version may be supplied according to availability.

2) When ordering I.E.C. Publications the reference number should be accurately quoted, especially in the case of Publications issued in a number of parts (e. g. 34, 50, 56, 68, 70, 98, 117, etc.). In these latter cases, for an order quoting only the reference number of the complete series, all the parts will be supplied (e. g. if an order merely quoted « Publication 34 » all three parts, viz. 34-1, 34-2 and 34-3 would be sent).

In case of doubt, the full title should be quoted in addition to the reference number.

N. B. — For the sake of completeness, this list contains a number of publications that are out of print and of which copies cannot be supplied.

3) I.E.C. Publications may be purchased either direct from Central Office of the I.E.C. (Sales Department) 1, rue de Varembé, Geneva, Switzerland.
or from any of the I.E.C. National Committees, a list of whose addresses will be supplied on request.

4) The prices quoted in this list apply only to direct sales from the I.E.C. Central Office. Postage is charged on all orders.

Numerical list of I.E.C. publications

Abstract

Explanation of signs.

* Publications marked with a single asterisk are under revision and a new edition is expected to be published shortly.

** A Russian/English version of publications marked with a double asterisk will be available later.

N.B. — For the sake of completeness, this list includes all I.E.C. publications that are of present-day interest, irrespective of whether copies are available for sale or not.

27 (1953)* *International letter symbols used in connection with electricity (Quantity symbols, alphabets and letter types).* 15 p., 3 fr. s., French-English.

Lists letter symbols used in electricity and gives rules for their use and combination. Specifies alphabets and letter types to be used.

50 : — *International Electrotechnical Vocabulary.*

A glossary of the terms, with their definitions, in English and French used in electrical engineering. The equivalent terms only are given in Dutch ([1]), German, Italian, Polish, Swedish and Spanish. Separate indices of the terms are given for each of the eight languages. The vocabulary is issued in the form of separate booklets, each dealing with a specific field.

50(05) (1954) *Fundamental definitions.* 102 p., 8 fr. s.

50(07) (1956) *Electronics* 157 p., 12 fr. s.

50(08) (1960) *Electro-acoustics.* 67 p., 10 fr. s.

50(20) (1958) *Scientific and industrial measuring instruments.* 88 p., 9 fr. s.

65 (1952)* *Safety requirements for electric mains-operated radio receiving apparatus.* 49 p., 5 fr. s., French-English.

Amendment 1 (1958). 11 p., 2 fr. s., French-English Russian-English.

This specification has been drawn up in complete agreement between the I.E.C. and the C.E.E. (International Commission for the Regulation and Control of Electrical Equipment) and supersedes the C.E.E. Publication of June 1948 on the same subject. It is identical with C.E.E. Publication No 1. Applies to radio receiving apparatus for domestic or similar general use in dry locations for connection to the supply mains either directly or through the intermediary of auxiliary apparatus. Concerns only the safety aspects of radio receiving apparatus and auxiliary apparatus.

65-1 (1955) *Appendix I. Particular specification for electric mains-operated amplifiers.* 31 p., 4 fr. s. French-English.

Extends Publication 65 to cover electric mains-operated amplifiers.

([1]) Except in Publications 50(05), 50(10) and 50(70).

65-2 (1955) *Appendix II. Particular specification for independent loud-speakers.* 23 p., 4 fr. s., French-English.

Extends Publication 65 to cover independent loudspeakers.

65-3 (1960) *Appendix III. Particular specification for electric mains operated television receiving apparatus.* 24 p., 4 fr. s., French-English**

Extends Publication 65 to cover electric mains-operated television receivers.

67 (1954) *Dimensions of electronic tubes and valves.* 1st edition 1954 including the 1st and 2nd supplements.97 p., 15 fr. s. French-English.

Gives the dimensions with the necessary tolerances, of electronic tube and valve bases, holders and caps, together with the relevant gauges and gauging procedure, to ensure interchangeability. This is a loose-leaf publication and supplements containing new and revised sheets are issued from time to time.

1st supplement (1955) 2 fr. s. French-English,
2nd supplement (1957) 8 fr. s. French-English,
3rd supplement (1958) 6 fr. s. French-English, Russian-English
4th supplement (1960) 6 fr. s. French/English**

68 : — *Recommended basic climatic and mechanical robustness testing procedure for components for electronic equipment.*

Describes a standard general procedure for climatic and mechanical robustness tests, designed to assess the durability, under various conditions of use, transport and storage of components used in equipment for tele communication and in electronic equipment employing similar techniques. This publication is issued in two parts, as follows :

68-1 (1960) *Part 1. General.*

General description of the framework of the test procedure and how it is to be used. 28 p., 8 fr. s., French-English**

68-2 (1960) *Part 2. Tests.*

Describes the different tests in detail. This part is issued in loose-leaf form and supplements will be issued from time to time. 64 p., 18 fr. s., French-English**

69 (1954)* *Recommended methods of measurement on receivers for amplitude-modulation broadcast transmissions.* 91 p., 10 fr. s., French-English.

Recommends conditions and methods of measurement for assessing and comparing the performances of radio receivers for amplitude-modulation sound broadcasting designed for loudspeaker reception in the frequency range between 150 kHz (kc/s) and 26.1 MHz (Mc/s) and applies both to mains and battery operated receivers.

Constitutes only a catalogue of selected measurements for assessing the essential properties of receivers of a given type and does not lay down criteria of quality.

70 : — *Specification for capacitors for power systems.*

Applies to capacitor units and assemblies of such units with accessories forming complete capacitor equipments, for connection to a. c. low and high voltage power systems having a frequency up to 100 Hz (c/s) which are intended for power factor correction and for coupling with other electric systems, for over-voltage protection and other low frequency a. c. applications, under stipulated altitude and temperature conditions.

Lays down safety regulations, rules regarding performances, type and routine tests, rating, and guidance for installation and operation.

This publication is issued in three parts as follows :

70-1 (1954) *Part* 1. 17 p., 3 fr. s., French-English.

Contains sections on general requirements, safety requirements and quality requirements and tests.

70-2 (1955) *Part* 2. 17 p., 3.75 fr. s. French-English.

Contains a section on ratings, gives guidance for installation and operation.

70-3 (1957) *Part* 3. 11 p., 3 fr. s., French-English.

Extends Parts 1 and 2 to cover capacitors for use under tropical conditions.

91 (1958) *Recommended methods of measurement on receivers for frequency-modulation broadcast transmissions.* 90 p., 15 fr. s., French-English, Russian-English.

Recommends conditions and methods of measurement for assessing and comparing the performances of radio receivers for frequency-modulation sound broadcasting designed for loudspeaker reception in the frequency range between 87.5 MHz (Mc/s) and 108 MHz (Mc/s), and applies to both mains and battery operated receivers.

Constitutes only a catalogue of selected measurements for assessing the essential properties of a given type and does not lay down criteria of quality.

96 : — *Recommendations for radio-frequency cables.*

Lays down requirements for flexible or semi-flexible radio-frequency cables of coaxial or twin conductor types designed for use in radio-communication equipment and in electronic devices employing similar techniques. The dielectric may be of the

solid, air-spaced, or semi-air-spaced types, consisting of a thermoplastic of low-loss polymeric resin or of a thermosetting compound, or of a mineral material.

Establishes uniform requirements for judging the electrical, climatic and mechanical properties of radio-frequency cables and describes test methods. For standard characteristic impedances and dimensions, see publication 78.

This publication will be issued in several parts.

96-1 (1958) *Part. 1. General requirements and measuring methods.* 32 p., 7.50 fr. s. French-English, Russian-English.

This part contains general requirements, electrical, climatic and mechanical robustness tests and specifies methods of marking.

100 (1958)* *Recommended methods for the measurement of direct interelectrode capacitances of electronic tubes and valves.* 52 p., 10 fr. s., French-English, Russian-English.

Applies to the measurement of the direct interelectrode capacitances of electronic tubes and valves of the following types, receiving tubes and valves, cathode-ray tubes, gas tubes and gas-filled valves, phototubes, photocells and multiplier types, high-power vacuum tubes and valves.

Includes tables of electrode connections to be used for the measurements and descriptions of methods of measurement. Gives also detailed specifications for the standard sockets, shields and cap connectors to be used in the measurements.

106 (1959) *Recommended methods of measurement of radiation from receivers for amplitude-modulation, frequency-modulation and television broadcast transmissions.* 34 p., 9 fr. s., French-English**

Contains descriptions of standardized methods of test for determining the radiation from broadcast radio and television receivers to enable comparison of the results of radiation measurements obtained by different observers. Limiting values of the various quantities for acceptable performance are not specified.

Contains the following sections, measurement of radiation at frequencies below 30 MHz (Mc/s), and measurement of radiation at frequencies between 30 and 300 MHz (Mc/s).

107 (1960) *Recommended methods of measurement on receivers for television broadcast transmissions.* 151 p., 25 fr. s. French-English**

Describes methods of measuring the electrical, acoustic and optical properties of television broadcast receivers designed for monochrome vision reception of 405, 525, 625 and 819 line transmissions, of either negative or positive modulation and the associated a. m. or f. m. sound channel. Constitutes only

a catalogue of selected measurements for assessing the essential properties of receivers of a given type and does not lay down criteria of quality.

108 (1959) *Recommendations for ceramic dielectric capacitors Type I.* 51 p., 10 fr. s., French-English**

Applies to fixed ceramic dielectric capacitors of a type specifically suited for resonant circuit application or any other applications where low losses and high stability of capacitance are essential, but excluding capacitors for r. f. currents exceeding 1 A or for a reactive power exceeding 200 var, for telecommunication equipment and in electronic devices employing similar techniques.

Lays down uniform requirements for judging the mechanical, electrical and climatic properties of these capacitors, describes test methods and gives a colour code for the marking of values of capacitance and tolerance. Includes recommendations for classification into groups according to the ability of capacitors to withstand conditions as specified in publication 68.

110 (1959) *Recommendations for power capacitors for frequencies between* 100 *and* 20.000 *Hz* (*c/s*). 23 p., 6 fr. s., French-English**

Applies to power capacitor units and assemblies of such units complete with accessories forming complete capacitor equipments, for connection to a. c. circuits, other than power-frequency distribution systems, with a frequency between 100 and 20.000 Hz (c/s) for use for power factor correction and other modifications of circuit characteristics, such as frequency adjustment. Lays down conditions of use, safety requirements, quality requirements, tests and ratings. Also gives guidance on installation and operation.

124 (1960) *Recommendations for the rated impedances and dimensions of loudspeakers.* 8 p., 3 fr. s., French-English**

Applies to single moving-coil loudspeakers of the direct radiator type. Lays down values of the rated impedance of the moving coil (transformer excluded) and the size and arrangement of the fixing holes.

Supplement to list of I.E.C. publications, 1960

International Special Committee on Radio Interference (*C.I.S.P.R.*)

C.I.S.P.R. 1 (First edition) : Specification for C.I.S.P.R. radio interference measuring apparatus for the frequency range 0.15 Mc/s to 30 Mc/s, price : 12 fr. s.

C.I.S.P.R. 2 (First edition) Specification for C.I.S.P.R. radio interference measuring apparatus for the frequency range 25 Mc/s to 300 Mc/s, price : 12 fr. s.

The following publications are in the press. The expected date of issue is shown in parentheses after the title.

64 (Third edition) : Tungsten filament lamps for general lighting service (May 1961).

96-1 (Second edition) : Radio-frequency cables. Part I : General requirements and measuring methods (July 1961) .

96-2 (First edition) : Radio-frequency cables. Part II : Relevant cable specifications (July 1961).

100 (Second edition) : Recommended methods for the measurement of direct interelectrode capacitances of electronic tubes and valves (July 1961).

122-1 (First edition) : Quartz crystal units for oscillators. Section one : specification. Section two : measuring methods (June 1961).

122-3 (First edition) : Quartz crystal units for oscillators. Section four : holder dimensions (June 1961).

125 (First edition) : General classification of ferromagnetic oxide materials and definitions of terms (June 1961).

135 (First edition) : Numbering system for electronic tubes and valves (June 1961).

International Electrotechnical Commission

Publication 78. *Second edition.* — Characteristic impedances and dimensions of radio-frequency coaxial cables. This publication lays down these parameters of r. f. cables without entering into details of construction or giving methods of test. The second edition which has just been issued, differs from the first in that it is no longer limited to coaxial cables with a dielectric of solid polyethylene, as was previously the case.

Publication 81. — *Second edition.* — Tubular fluorescent lamps for general lighting service.

Publication 126. — *First edition.* — I.E.C. reference coupler for the measurement of hearing aids using earphones coupled to the ear by means of ear inserts.

Publication 133. — *First edition.* — Dimensions for pot-cores made of ferromagnetic oxides.

These publications are on sale at the Central Office of the I.E.C., at the price of 3 fr. s., per copy, plus postage, for publications 78 and 133, 4 fr. s.,

per copy, plus postage, for publication 126, and 15 fr. s., per copy, plus postage, for publication 81.

International Telecommunication Union

List of Coast Stations, 1st edition, 1960.

List of Ship Stations, 1st edition, 1960.

According to the Radio Regulations, these lists should be in the possession of stations on board ships which are obliged to have a radiotelegraph station. They could also be of great use to other ship stations, shipowners, life-saving institutions, transport companies, etc.

The list of coast stations contains : A preface. An alphabetical index of coast stations. The particulars of coast stations throughout the world, arranged by countries in alphabetical order. Data includes the name of the station, call sign, frequencies used, emission classes and powers, type of service provided, operating hours, charges, geographical position, the operating agency and any other information of use for operational purposes. At the end of this volume there is some information about inland and limitrophic telegraph rates for the routing of correspondence to the country where the coast station is situated or to limitrophic countries.

This list will be kept up to date by means of half-yearly summary supplements.

The list of ship stations contains : A preface. The particulars of ship stations in alphabetical order, regardless of the nationality. The data includes the name of the ship, call sign, country responsible for the station, frequencies used, emission classes and powers, type of service provided, operating hours, charges levied for the exchange of correspondence, the accounting authorities and, where applicable, the shipowners, the number of lifeboats fitted with radio apparatus, etc. At the end of this table there is a table of observations regarding ship stations.

The titles on the covers and the explanatory texts are in English, French and Spanish.

The sale prices of these Lists, including packing costs and carriage by ordinary mail are as follows :

List of coast stations, including the half-yearly supplements (530 pages) : 10 fr. s.

List of ship stations (524 pages) : 6.15 fr. s.